

**KPK BOARD
NOTES**

GENERAL MATHEMATICS

**9TH
CLASS**

Presented by:

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Unit .1: Percentage , Ratio , and Ratio:

Percentage: Percent means out of hundred . It is expressed by the symbol % .

Example 1: Convert 65 % into common fraction and write it in the simplest form .

Ans: To convert 65% into common fraction . Then

multiplied it by $\frac{1}{100}$.

$$65 \% = 65 \times \frac{1}{100} = \frac{65}{100} = \frac{13}{20}$$

Example : 2: Convert $42\frac{1}{2}\%$ into a common fraction .

Ans. $42\frac{1}{2}\% = \frac{85}{2} \times \frac{1}{100} = \frac{17}{2} \times \frac{1}{20} = \frac{17}{40}$

Example 4: Convert $\frac{2}{5}$ into percentage.

Ans. $\frac{2}{5} = \frac{2}{5} \times 100 \% = 2 \times 20\% = 40 \%$

Exercise: 1.1:

Convert the following percentages into common fractions.

Q. 1: 79 %

Ans: $79 \% = 79 \times \frac{1}{100} = \frac{79}{100}$

Q.2: 45 %

Ans: $45\% = 45 \times \frac{1}{100} = \frac{45}{100} = \frac{9}{20}$

Q.3: 36 %

Ans: $36\% = 36 \times \frac{1}{100} = \frac{36}{100} = \frac{9}{25}$

Q.4: 95 %

Ans: $95\% = 95 \times \frac{1}{100} = \frac{95}{100} = \frac{19}{20}$

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Q.5: 70 %

$$\text{Ans: } 70\% = 70 \times \frac{1}{100} = \frac{70}{100} = \frac{7}{10}$$

Q.6: 7 %

$$\text{Ans: } 7\% = 7 \times \frac{1}{100} = \frac{7}{100}$$

Q.7 : 5 %

$$\text{Ans: } 5\% = 5 \times \frac{1}{100} = \frac{5}{100} = \frac{1}{20}$$

Q.8: $16\frac{1}{2}$ %

$$\text{Ans: } 16\frac{1}{2}\% = \frac{33}{2} = \frac{33}{2} \times \frac{1}{100} = \frac{33}{200}$$

Q.9: $43\frac{1}{5}$ %

$$\text{Ans: } 43\frac{1}{5}\% = \frac{216}{5}\% = \frac{216}{5} \times \frac{1}{100} = \frac{54}{5} \times \frac{1}{25} = \frac{54}{125}$$

Q.10 : 1596 %

$$\text{Ans: } 1596\% = 1596 \times \frac{1}{100} = \frac{1596}{100} = \frac{399}{25}$$

Q.11 : 150 %

$$\text{Ans: } 150\% = 150 \times \frac{1}{100} = \frac{15}{10} = \frac{3}{2}$$

Q.12: $196\frac{2}{3}$ %

$$\text{Ans: } 196\frac{2}{3}\% = \frac{590}{3}\% = \frac{590}{3} \times \frac{1}{100} = \frac{59}{3} \times \frac{1}{10} = \frac{59}{30}$$

Convert the following fractions into percentages:

Q.13: $\frac{1}{2}$

$$\text{Ans. } \frac{1}{2} = \frac{1}{2} \times 100\% = 50\%$$

ختم نبوت ﷺ زندہ باد

عظمت صحابہ زندہ باد

السلام علیکم ورحمۃ اللہ وبرکاتہ:

معزز ممبران: آپ کا وٹس ایپ گروپ ایڈمن "اردو بکس" آپ سے مخاطب ہے۔

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اللہ تبارک تعالیٰ ہم سب کا حامی و ناصر ہو

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Q.14: $\frac{1}{4}$

Ans. $\frac{1}{4} = \frac{1}{4} \times 100 \% = 25 \%$

Q.15: $\frac{13}{20}$

Ans. $\frac{13}{20} = \frac{13}{20} \times 100 \% = 13 \times 5 \% = 65 \%$

Q.16: $\frac{3}{8}$

Ans. $\frac{3}{8} = \frac{3}{8} \times 100 \% = \frac{3}{2} \times 25 \% = \frac{75}{2} \% = 37.5\%$

Q.17: $\frac{5}{16}$

Ans. $\frac{5}{16} = \frac{5}{16} \times 100 \% = \frac{5}{4} \times 25 \% = \frac{125}{4} \% = 31.25\%$

Q.18: $\frac{5}{24}$

Ans. $\frac{5}{24} = \frac{5}{24} \times 100 \% = \frac{5}{6} \times 25 \% = \frac{125}{6} \% = 20.833 \%$

Q.19: $\frac{6}{35}$

Ans. $\frac{6}{35} = \frac{6}{35} \times 100 \% = \frac{6}{7} \times 20 \% = \frac{120}{7} \% = 17\frac{1}{7}\%$

Q.20: $\frac{27}{32}$

Ans. $\frac{27}{32} = \frac{27}{32} \times 100 \% = \frac{27}{8} \times 25 \% = \frac{675}{8} \% = 84\frac{3}{8}\%$

Q.21: $1\frac{3}{7}$

Ans. $1\frac{3}{7} = \frac{10}{7} = \frac{10}{7} \times 100 \% = \frac{1000}{7} \% = 142\frac{6}{7}\%$

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Q.22 : $1\frac{7}{40}$

Ans. $1\frac{7}{40} = \frac{47}{40} = \frac{47}{40} \times 100\% = \frac{470}{4}\% = 117\frac{2}{4}\%$

Q.23 : $2\frac{3}{55}$

Ans. $2\frac{3}{55} = \frac{113}{55} = \frac{113}{55} \times 100\% = \frac{113}{11} \times 20\% = \frac{2260}{11}\%$

Q.24 : $2\frac{7}{9}$

Ans. $2\frac{7}{9} = \frac{25}{9} = \frac{25}{9} \times 100\% = \frac{2500}{9}\% = 277\frac{7}{9}\%$

Exercise. 1.2

Convert the following percentages into decimal fractions . .

Q .1 : 13 %

Ans : $13\% = \frac{13}{100} = 0.13$

Q .2 : 33 %

Ans : $33\% = \frac{33}{100} = 0.33$

Q .3 : 86 %

Ans : $86\% = \frac{86}{100} = 0.86$

Q .4 : 20 %

Ans : $20\% = \frac{20}{100} = 0.2$

Q .5 : 50 %

Ans : $50\% = \frac{50}{100} = 0.5$

Q .6 : 90 %

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$$\text{Ans: } 90 \% = \frac{90}{100} = 0.9$$

Q.7: 11.2 %

$$\text{Ans: } 11.2 \% = \frac{11.2}{100} = 0.112$$

Q.8: 25.5 %

$$\text{Ans: } 25.5 \% = \frac{25.5}{100} = 0.255$$

Q.9: 73.9 %

$$\text{Ans: } 73.9 \% = \frac{73.9}{100} = 0.739$$

Q.10: 1.4 %

$$\text{Ans: } 1.4 \% = \frac{1.4}{100} = 0.014$$

Q.11: 3.6 %

$$\text{Ans: } 3.6 \% = \frac{3.6}{100} = 0.036$$

Q.12: 9.9 %

$$\text{Ans: } 9.9 \% = \frac{9.9}{100} = 0.099$$

Q.13: 3 %

$$\text{Ans: } 3 \% = \frac{3}{100} = 0.03$$

Q.14: 7 %

$$\text{Ans: } 7 \% = \frac{7}{100} = 0.07$$

Q.15: 9 %

$$\text{Ans: } 9 \% = \frac{9}{100} = 0.09$$

Convert the following decimal fractions into percentages

Q.16: 0.16

$$\text{Ans. } 0.16 = \frac{16}{100} = 16 \%$$

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Q.17: 0.21

Ans. $0.21 = \frac{21}{100} = 21 \%$

Q.18 : 0.91

Ans. $0.91 = \frac{91}{100} = 91 \%$

Q.19 : 0.3

Ans. $0.3 = \frac{3}{10} \times \frac{10}{10} = \frac{30}{100} = 30 \%$

Q.20 : 0.8

Ans. $0.8 = \frac{8}{10} \times \frac{10}{10} = \frac{80}{100} = 80 \%$

Q.21 : 0.1

Ans. $0.1 = \frac{1}{10} \times \frac{10}{10} = \frac{10}{100} = 10 \%$

Q.22 : 0.03

Ans. $0.03 = \frac{3}{100} = 3 \%$

Q.23: 0.08

Ans. $0.08 = \frac{8}{100} = 8 \%$

Q.24: 0.01

Ans. $0.01 = \frac{1}{100} = 1 \%$

Q.25 : 0.029

Ans. $0.029 = \frac{29}{1000} = \frac{29}{10} \times \frac{1}{100} = 2.9 \times \frac{1}{100} = 2.9 \%$

Q.26: 0.067

Ans. $0.067 = \frac{67}{1000} = \frac{67}{10} \times \frac{1}{100} = 6.7 \times \frac{1}{100} = 6.7 \%$

Q.27: 0.084

Ans. $0.084 = \frac{84}{1000} = \frac{84}{10} \times \frac{1}{100} = 8.4 \times \frac{1}{100} = 8.4 \%$

Q.28: 0.001

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Ans.

$$0.001 = \frac{1}{1000} = \frac{1}{10} \times \frac{1}{100} = 0.1 \times \frac{1}{100} = 0.1 \%$$

Q.29: 0.007

$$\text{Ans. } 0.007 = \frac{7}{1000} = \frac{7}{10} \times \frac{1}{100} = 0.7 \times \frac{1}{100} = 0.7 \%$$

Q.30: 0.009

$$\text{Ans. } 0.009 = \frac{9}{1000} = \frac{9}{10} \times \frac{1}{100} = 0.9 \times \frac{1}{100} = 0.9 \%$$

Exercise 1.3:

Q.1: A factory worker is given 15 % increase in his salary .If he was getting Rs 9600 per month , how much will he get after the increase .

Ans: Salary of worker = 9600

Increase in salary = 15 %

$$\begin{aligned} \text{Total increase} &= 9600 \times 15 \% = 9600 \times \frac{15}{100} \\ &= 96 \times 15 = \text{Rs } 1440 \end{aligned}$$

$$\text{Total salary} = 9600 + 1440 = \text{Rs } 11040$$

Q.2: Number of employees in an organization is 960. Out of these 85 % are graduates . Find the number of non – graduates .

Ans. Number of employees = 960

Number of graduates employees = 85 % out of 960

$$\begin{aligned} &= 960 \times 85 \% = 960 \times \frac{85}{100} \\ &= 96 \times \frac{85}{10} = \frac{8160}{10} = 816 \end{aligned}$$

The number of non – graduates = 960 – 816 = 144 . ans

Q.3: Asim rented a house for Rs. 8500 per month . He was asked to deposit 150 % of the monthly house rent as security along with the first month,s rent .

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How much did he pay in all .

Ans. Monthly hose rent = Rs 8500

For security deposited = 150 % of house rent

$$= 8500 \times 150\% = 8500 \times \frac{150}{100}$$

$$= 850 \times 15 = \text{Rs.} 12750$$

Q.4: A school has the enrolment of 3600 students . If 88 % of the students reside in the hostels . Find the number of day scholars .

Ans. Total numbers of students in school = 3600

Students reside in hostels = 88 % out of 3600

$$= 3600 \times 88\% = 3600 \times \frac{88}{100}$$

$$= 36 \times 88 = 3168$$

Numbers of day scholars students = $3600 - 3168 = 432$

Q.5: Population of a village is 5400 . If 31 % of the population is women . 33 % are men and the rest are children . Find the number of women , men and children .

Ans. Population of a village = 5400

Number of women = 31 % out of 5400

$$= 5400 \times \frac{31}{100} = 54 \times 31 = 1674 \text{ women .}$$

Number of men = 33 % out of 5400

$$= 5400 \times \frac{33}{100} = 54 \times 33 = 1782 \text{ men .}$$

Numbers of children = Total population - (Numbers of men and women)

$$= 5400 - (1674 + 1782) = 5400 - 3456$$

$$= 1944 \text{ Children}$$

Q.6: Maryam reduced her weight by 6.25 % . If her present weight is 45 kg , what was her actual weight .

Ans. Let Maryam actual weight = x kg

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Present weight = 45 kg

Reduce in weight = 62.5 % out of x .

Then 45 kg = 62.5% × x

$$\Rightarrow 45 = \frac{62.5}{100} x \quad \Rightarrow 45 \times 100 = 62.5 x$$

$$\Rightarrow x = \frac{4500}{62.5} = 72$$

Thus the actual weight of meryam = 72 kg .

Q.7: Feroz had Rs. 5000 in his saving account . He then deposited some amount which increased his saving by 12 % . What was his new balance .

Ans. Total amount in account = Rs 5000 .

Increase in amount = 12 % out of 5000 .

$$= \frac{12}{100} \times 5000 = 12 \times 50 = 600$$

New balance = 5000 + 600 = Rs . 5600

Q.8: After driving 54 km , scated saced found that he has covered only 18 % of the distance . How much distance he had to cover .

Ans. Let Total distance = x km

According to the conditions

$$18\% \times x = 54$$

$$\Rightarrow \frac{18}{100} x = 54 \quad \Rightarrow x = 54 \times \frac{100}{18}$$

$$\Rightarrow x = 3 \times 100 = 300 \text{ km}$$

Thus total distance = 300 km .

Q.9: Rashida contributes 6 % her pay toward G .P . Fund .

If she contributes Rs. 1440 per month . What is her monthly pay .

Ans. Let monthly pay of rashida = x

For G .P .Fund = 6 %

According to condition

$$6\% \times x = 1440$$

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$$\Rightarrow \frac{6}{100}x = 1440$$

$$\Rightarrow x = \frac{1440 \times 100}{6} = 240 \times 100$$

$$\Rightarrow x = 24000$$

Thus salary of rashida = Rs. 24000

Q.10. On rainy day , 5 % of the students could not come to School . If the total number of students in the school in the school is 1360 , how many students were present on that day .

Ans. Total number of students = 1360

Number of students could not come to school = 5 %
= 5% × 1360

$$= \frac{5}{100} \times 1360 = \frac{5}{10} \times 136$$

$$= \frac{1}{2} \times 136 = 68$$

Thus number of students which could not come to School = 68 .

Q.11: In a school library there are 1314 books on Mathematics . If these books are 18 % of the total books , find the number of books in the school library .

Ans. Let Total books = x

Mathematics books = 1314

According to the given conditions

$$18 \% \times x = 1314$$

$$\Rightarrow \frac{18}{100} x = 1314 \quad \Rightarrow x = \frac{1314 \times 100}{18}$$

$$\Rightarrow x = 7300$$

Total books in library = 7300 .

Q.12. Price of petrol was reduced by $3\frac{1}{3}\%$. Its new price is

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Rs 58 per liter . Find its original price .

Ans. Let petrol price = x .

$$\text{Petrol was reduced} = 3\frac{1}{3}\% = \frac{10}{3}\%$$

$$100 - \frac{10}{3} \\ = \frac{300 - 10}{3} = \frac{290}{3} = 96.66$$

If original price is 100 then reduce to 96.66 .

Then	New price	original price
	96.66	100
	x	58

$$\text{Then } 96.66 \ x = 100 \times 58$$

$$\Rightarrow x = \frac{5800}{96.66} = 60.004$$

Thus new price is = Rs 60.004

Q. 13: The population of a town has increased by 1.9 % .

If its present population is 15285 , what was its previous Population .

Ans. Previous population = x

Present population = 15285

Increase in population = 1.9 %

Then if population is 100 then increase 1.9

Then new population is $100 + 1.9 = 101.9$

Previous population	Present population
100	101.9
x	15285

$$\Rightarrow \frac{x}{100} = \frac{15285}{101.9} \Rightarrow x = \frac{15285}{101.9} \times 100$$

$$\Rightarrow x = 1500$$

Thus previous population = 1500

Q. 14: A cricket team scored 290 runs in first inning . It improved its score by 10 % in the second inning .

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What was the team score in both the innings .

Ans: First inning score = 290

Increase in score in second inning = 10 %

$$= \frac{10}{100} \times 290 = 29$$

Second innings score = 290 + 29 = 319

Thus total scores = 290 + 319 = 609

Q.15 : At the end of an academic session , total enrolment of a school was 1987 . Out of the same , 137 students left the school after appearing in S . S . C . Examination . 10 % of the remaining students were admitted to various classes during the new session . Find its present enrolment .

Ans. Total students = 1987

The number of students left the school = 137

The remaining students = 1987 – 137 = 1850

Number of Admitted students = 10 % × 1850

$$= \frac{10}{100} \times 1850 = 185$$

**Total numbers of students after admission = 1850 + 185
= 2035**

Q.16: Saba estimated to get a new dress for Rs 1500 , but She spent 0.8 % more than her estimates . How much did she pay for the dress .

Ans. Estimated amount = Rs 1500

More spent = 0.8 % × 1500

$$= \frac{0.8}{100} \times 1500 = 0.8 \times 15 = 12$$

Saba pay total amount = 1500 + 12 = 1512

Ratio: Comparing of two quantities of the same kind is called ratio .

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Exercise 1.4:

Q.1 : Express ratios between the given quantities in simplest form .

(i) 16 plants and 20 plants

(ii) 3.2 decagram and 0.48 decagram

(iii) 1.75 km and 850 m (iv) 800 gm and 2.8kg

(v) 3 hours and 2 hours and 15 minutes

(vi) 1 km 25 m and 775 m (vii) $15\frac{3}{4}$ km and $13\frac{1}{2}$ km

(viii) 13.52 litre and 10.4 litre (ix) $1\frac{7}{8}$ m and 225cm

(x) 3.61 g and 4769 mg

Ans: (i) Plants : Plants
 16 : 20 divided by 4
 4 : 5

(ii)

(iii) As 1 km = 1000 m

Then 1.75 km = $1.75 \times 1000 = 1750$ m

 m : m
 1750 : 850 Divided by 10
 175 : 85 Divided by 5
 35 : 17

(iv) As 1kg = 1000 gm

Then 2.8 kg = $2.8 \times 1000 = 2800$ gm

 gm : gm
 800 : 2800 Divided by 100
 8 : 28 Divided by 4
 2 : 7

(v) As 1 hour = 60 minutes

3 hours = $3 \times 60 = 180$ minutes

2 hours and 15 minutes = $2 \times 60 + 15 = 120 + 15 = 235$ min

Minutes : Min utes
 180 : 235 Divided by 5

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$$36 : 47$$

(vi) As 1 km = 1000 m

$$1 \text{ km and } 25 \text{ m} = 1000 + 25 = 1025 \text{ m}$$

$$\begin{array}{rcl} \text{m} & : & \text{m} \\ 1025 & : & 775 \text{ divided by } 5 \\ 205 & : & 155 \text{ divided by } 5 \\ 41 & : & 31 \end{array}$$

(vii) Km : Km

$$\begin{array}{rcl} 15\frac{3}{4} & : & 13\frac{1}{2} \\ \frac{63}{4} & : & \frac{27}{2} \text{ multiplied by } 8 \\ \frac{63}{4} \times 8 & : & \frac{27}{2} \times 8 \\ 63 \times 2 & : & 27 \times 4 \\ 63 & : & 54 \text{ Divided by } 2 \\ 7 & : & 6 \text{ Divided by } 9 \end{array}$$

(viii) Liter : Liter

$$\begin{array}{rcl} 13.52 & : & 10.4 \\ 13.52 \times 100 & : & 10.4 \times 100 \text{ multiplied by } 100 \\ 1352 & : & 1040 \text{ Divided by } 2 \\ 676 & : & 520 \text{ Divided by } 4 \\ 169 & : & 130 \end{array}$$

(ix) As 1 m = 100 cm

$$\text{Then } 1\frac{7}{8} \text{ m} = \frac{15}{8} \text{ m} = \frac{15}{8} \times 100 = \frac{15}{2} \times 25 = \frac{375}{2} \text{ cm}$$

$$\begin{array}{rcl} \text{Cm} & : & \text{Cm} \\ \frac{375}{2} & : & 225 \text{ multiplied by } 2 \\ \frac{375}{2} \times 2 & : & 225 \times 2 \\ 375 & : & 450 \text{ Divided by } 5 \\ 75 & : & 90 \text{ Divided by } 15 \end{array}$$

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$$\begin{array}{rcl} 5 & : & 6 \\ \text{(x) As } 1 \text{ g} & = & 1000 \text{ mg} \\ 3.61 \text{ g} & = & 3.61 \times 1000 = 3610 \text{ mg} \\ \text{mg} & : & \text{mg} \\ 3610 & : & 4769 \quad \text{Divided by 19} \\ 190 & : & 251 \end{array}$$

Q.2: In what ratio be :

- (i) 36 decreased to become 27?
- (ii) 9.2 decreased to become 3.45?
- (iii) $6\frac{3}{4}$ decreased to become $2\frac{13}{16}$?
- (iv) 45 increased to become 105?
- (v) 27 increased to become 36.9?
- (vi) 7.2 increased to become 18?

Ans: (i) Given number = 36

$$\begin{array}{l} \text{Resulting number after proportion decreased} = 27 \\ \text{The required ratio} = 27 : 36 \quad \text{Divided by 9} \\ 3 : 4 \end{array}$$

(ii) Given number = 9.2

$$\begin{array}{l} \text{Resulting number after proportion decreased} = 3.45 \\ \text{The required ratio} = 9.2 : 3.45 \quad \text{multiplied by 100} \\ 9.2 \times 100 : 3.45 \times 100 \\ 920 : 345 \quad \text{Divided by 5} \\ 184 : 69 \quad \text{Divided by 23} \\ 8 : 3 \end{array}$$

(iii) Given number = $6\frac{3}{4} = \frac{27}{4}$

$$\text{Resulting number after proportion decreased} = 2\frac{13}{16} = \frac{45}{16}$$

$$\begin{array}{l} \text{The required ratio} = \frac{27}{4} : \frac{45}{16} \quad \text{multiplied by 16} \\ \frac{27}{4} \times 16 : \frac{45}{16} \times 16 \\ 27 \times 4 : 45 \\ 108 : 45 \quad \text{Divided by 9} \end{array}$$

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$$12 : 5$$

(iv) Given number = 45

Resulting number after proportion increased = 105

The required ratio = 105 : 45 Divided by 15

$$7 : 3$$

(v) Given number = 27

Resulting number after proportion increased = 36.9

The required ratio = 27 : 36.9 multiplied by 10

$$27 \times 10 : 36.9 \times 10$$

$$270 : 369 \text{ Divided by 3}$$

$$90 : 123 \text{ Divided by 3}$$

$$30 : 41$$

(vi) Given number = 7.2

Resulting number after proportion increased = 18

The required ratio = 7.2 : 18 multiplied by 10

$$7.2 \times 10 : 18 \times 10$$

$$72 : 180 \text{ Divided by 9}$$

$$8 : 20 \text{ Divided by 4}$$

$$2 : 5$$

Q.3: Aimal got 12 out of 30 marks in his weakly test. His teacher advised him to work hard and give him a target of securing 70 % marks in his next test. In what ratio should he improve his marks to achieve the target ?

Ans: Got numbers in test = 12 out of 30

$$= \frac{12}{30} = \frac{4}{10} \times \frac{10}{10} = \frac{40}{100} = 40\%$$

Target marks = 70 %

Required ratio = 70 : 40 Divided by 10

$$7 : 4$$

Q.4: Shumaiala and Hina saved Rs 325 and RS 450 out of their monthly salaries of Rs 8000 and Rs 10000 respectively. Who saved more.

Ans: Shumaiala saved Rs 325 out of Rs 8000 = $\frac{325}{8000} = \frac{65}{1600}$

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$$\text{Hina saved 450 out of 10000} = \frac{450}{10000} = \frac{45}{1000} = \frac{9}{200}$$

Shumaila : Hina

$$\frac{65}{1600} \quad \text{or} \quad \frac{9}{200} \quad \text{multiplied by 1600}$$

$$\frac{65}{1600} \times 1600 \quad \text{or} \quad \frac{9}{200} \times 1600$$

$$65 \quad \text{or} \quad 9 \times 8$$

$$65 \quad \text{or} \quad 72$$

Thus Hina saved more .

Q.5: Umar spent Rs. 145 and Ali spent 175 out of their monthly pocket money of Rs 200 and Rs 250 respectively . Who spent comparatively more .

Ans . Umer spent Rs 145 out of Rs 200 = $\frac{145}{200} = \frac{29}{40}$

Ali spent Rs 175 out of Rs 250 = $\frac{175}{250} = \frac{7}{10}$

Umar : Ali

$$\frac{29}{40} \quad \text{or} \quad \frac{7}{10} \quad \text{multiplied by 40}$$

$$\frac{29}{40} \times 40 \quad \text{or} \quad \frac{7}{10} \times 40$$

$$29 \quad \text{or} \quad 7 \times 4$$

$$29 \quad \text{or} \quad 28$$

Thus Umer spent more .

Q.6: Zubaida scored 527 marks out of 850 in her SSC Exam
 And obtained 693 marks out of 1100 in her F.Sc Exam .
 In which examination did she perform better ? .

Ans. Zubaida scored 527 out of 850 in SSC Exam = $\frac{527}{850}$

(take 17 common factor) = $\frac{31 \times 17}{50 \times 17} = \frac{31}{50}$

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Zubaida scored 693 out of 1100 in F.S Exam = $\frac{693}{1100}$

$$(\text{Take 11 common factor}) = \frac{63 \times 11}{100 \times 11} = \frac{63}{100}$$

In SSC Exam : In F.Sc Exam.

$$\frac{31}{50} \quad \text{or} \quad \frac{63}{100} \quad \text{multiplied by 100}$$

$$\frac{31}{50} \times 100 \quad \text{or} \quad \frac{63}{100} \times 100$$

$$62 \quad \text{or} \quad 63$$

Thus in F.Sc Exam her perform is better .

Q.7: Nasir scored 58 runs in 1st inning and 85 runs in 2nd inning of a cricket match . If the same team scored 261 runs in 1st inning and 357 runs in the 2nd inning . In which inning nasir performance was better .

Ans. Nasir scored 58 runs out of 261 runs in 1st inning = $\frac{58}{261}$

$$= \frac{2 \times 29}{9 \times 29} = \frac{2}{9}$$

Nasir scored 85 runs out of 357 runs in 2nd inning = $\frac{85}{357}$

$$= \frac{5 \times 7}{21 \times 7} = \frac{5}{21}$$

In 1st inning : in 2nd inning

$$\frac{2}{9} \quad \text{or} \quad \frac{5}{21} \quad \text{multiplied by 63}$$

$$\frac{2}{9} \times 63 \quad \text{or} \quad \frac{5}{21} \times 63$$

$$2 \times 7 \quad \text{or} \quad 5 \times 3$$

$$14 \quad \text{or} \quad 15$$

Thus in 2nd inning his performance is better .

Q.8: Aslam bought 8.5 kg 3.25 kg of rice from two different stores . If first store charged him Rs 603.5 and the

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second gave him a bill of Rs 234, which store was comparatively cheaper.

Ans. 8.5 kg rice price is $603.5 = \frac{603.5}{8.5} = \frac{6035}{85} = \frac{1207}{17} = 71$

3.25 kg rice price is $234 = \frac{234}{3.25} = \frac{23400}{325}$
 $= \frac{4680}{65} = \frac{936}{13} = 72$

First store price : 2nd store price
 71 or 72

Thus the 1st store price is cheaper (less).

Proportion : A ratio of two quantities a and b is

$a : b$ or $\frac{a}{b}$. The equality of two ratios is called

Proportion. In general $\frac{a}{b} = \frac{c}{d}$ represent a proportion.

It can be also written as $a : b :: c : d \dots (i)$

So we write $ad = bc$ i.e.

Product of extremities = product of means

In (i) a and d are extremes and b, c are means.

Exercise 1.5:

Q.1: Which of the following are proportions.

(i) $1 : 5 :: 11 : 55$ (ii) $12 : 9 :: 36 : 27$

(iii) $\frac{1}{4} : \frac{3}{5} :: \frac{10}{27} : \frac{8}{9}$ (iv) $2 : 7 :: 4 : 9$

(v) $\frac{2}{3} : \frac{1}{14} :: 8 : \frac{6}{7}$ (vi) $\frac{1}{5} : \frac{2}{5} :: \frac{25}{26} : \frac{10}{13}$

Ans: (i) $1 : 5 :: 11 : 55$

Product of extremes = $1 \times 55 = 55$

Product of means = $5 \times 11 = 55$

As Product of extremes = Product of means

Thus $1 : 5 :: 11 : 55$ is a proportion.

(ii) $12 : 9 :: 36 : 27$

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$$\text{Product of extremes} = 12 \times 27 = 324$$

$$\text{Product of means} = 9 \times 36 = 324$$

As Product of extremes = Product of means

Thus $12 : 9 :: 36 : 27$ is a proportion.

$$(iii) \quad \frac{1}{4} : \frac{3}{5} :: \frac{10}{27} : \frac{8}{9}$$

$$\text{Product of extremes} = \frac{1}{4} \times \frac{8}{9} = \frac{2}{9}$$

$$\text{Product of means} = \frac{3}{5} \times \frac{10}{27} = \frac{2}{9}$$

As Product of extremes = Product of means

Thus $\frac{1}{4} : \frac{3}{5} :: \frac{10}{27} : \frac{8}{9}$ is a proportion.

$$(iv) \quad 2 : 7 :: 4 : 9$$

$$\text{Product of extremes} = 2 \times 9 = 18$$

$$\text{Product of means} = 7 \times 4 = 28$$

As Product of extremes \neq Product of means

Thus $2 : 7 :: 4 : 9$ is not a proportion.

$$(v) \quad \frac{2}{3} : \frac{1}{14} :: 8 : \frac{6}{7}$$

$$\text{Product of extremes} = \frac{2}{3} \times \frac{6}{7} = \frac{4}{7}$$

$$\text{Product of means} = \frac{1}{14} \times 8 = \frac{4}{7}$$

As Product of extremes = Product of means

Thus $\frac{2}{3} : \frac{1}{14} :: 8 : \frac{6}{7}$ is a proportion.

$$(vi) \quad \frac{1}{5} : \frac{2}{5} :: \frac{25}{26} : \frac{10}{13}$$

$$\text{Product of extremes} = \frac{1}{5} \times \frac{10}{13} = \frac{2}{13}$$

$$\text{Product of means} = \frac{2}{5} \times \frac{25}{26} = \frac{5}{13}$$

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As Product of extremes \neq Product of means

Thus $\frac{1}{5} : \frac{2}{5} :: \frac{25}{26} : \frac{10}{13}$ is not a proportion.

Q.2: Find x in the following proportions :

(i) $9 : 36 :: 5 : x$ (ii) $72 : 24 :: 27 : x$

(iii) $\frac{5}{7} : \frac{2}{3} :: \frac{5}{21} : x$ (iv) $2.5 : 10 :: 1.9 : x$

Ans: (i) $9 : 36 :: 5 : x$

As Product of extremes = Product of means

Then $9x = 36 \times 5$

$$\Rightarrow x = \frac{36 \times 5}{9} = 4 \times 5 = 20$$

(ii) $72 : 24 :: 27 : x$

As Product of extremes = Product of means

Then $72x = 24 \times 27$

$$\Rightarrow x = \frac{24 \times 27}{72} = \frac{27}{3} = 9$$

(iii) $\frac{5}{7} : \frac{2}{3} :: \frac{5}{21} : x$

As Product of extremes = Product of means

Then $\frac{5}{7}x = \frac{2}{3} \times \frac{5}{21}$

$$\Rightarrow x = \frac{10}{63} \times \frac{7}{5} = \frac{2}{9}$$

(iv) $2.5 : 10 :: 1.9 : x$

As Product of extremes = Product of means

Then $2.5x = 10 \times 1.9$

$$\Rightarrow x = \frac{19}{2.5} = \frac{19 \times 10}{25} = \frac{19 \times 2}{5} = \frac{38}{5}$$

Q.3: Find y in the following proportions :

(i) $7 : 15 :: y : 165$ (ii) $21 : 16 :: y : 4$

(iii) $\frac{3}{4} : \frac{7}{8} :: y : \frac{5}{48}$ (iv) $3.2 : 5.6 :: y : 2.8$

Ans: (i) $7 : 15 :: y : 165$

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As Product of means = Product of extremes

Then $15y = 7 \times 165$

$$\Rightarrow y = \frac{7 \times 165}{15} = 7 \times 11 = 77$$

(ii) $21 : 16 :: y : 4$

As Product of means = Product of extremes

Then $16y = 21 \times 4$

$$\Rightarrow y = \frac{21 \times 4}{16} = \frac{21}{4}$$

(iii) $\frac{3}{4} : \frac{7}{8} :: y : \frac{5}{48}$

As Product of means = Product of extremes

Then $\frac{7}{8}y = \frac{3}{4} \times \frac{5}{48} \Rightarrow \frac{7}{8}y = \frac{1}{4} \times \frac{5}{16}$

$$\Rightarrow y = \frac{5}{64} \times \frac{8}{7} = \frac{5}{8} \times \frac{1}{7} = \frac{5}{56}$$

(iv) $3.2 : 5.6 :: y : 2.8$

As Product of means = Product of extremes

Then $5.6y = 3.2 \times 2.8$

$$\Rightarrow y = \frac{8.96}{5.6} = 1.6$$

Q.4: Find x in the following proportions :

(i) $11 : x :: 55 : 95$ (ii) $13 : x :: 143 : 33$

(iii) $\frac{8}{9} : x :: \frac{35}{22} : \frac{7}{4}$ (iv) $5.8 : x :: 2.9 : 3.7$

Ans: (i) $11 : x :: 55 : 95$

As Product of means = Product of extremes

Then $55x = 11 \times 95$

$$\Rightarrow x = \frac{11 \times 95}{55} = \frac{95}{5} = 19$$

(ii) $13 : x :: 143 : 33$

As Product of means = Product of extremes

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Then $143x = 13 \times 33$

$$\Rightarrow x = \frac{13 \times 33}{143} = \frac{33}{11} = 3$$

(iii) $\frac{8}{9} : x :: \frac{35}{22} : \frac{7}{4}$

As Product of means = Product of extremes

Then $\frac{35}{22} x = \frac{7}{4} \times \frac{8}{9}$

$$\Rightarrow x = \frac{14}{9} \times \frac{22}{35} = \frac{2}{9} \times \frac{22}{5} = \frac{44}{45}$$

(iv) $5.8 : x :: 2.9 : 3.7$

As Product of means = Product of extremes

Then $2.9x = 5.8 \times 3.7$

$$\Rightarrow x = \frac{21.46}{2.9} = 7.4$$

Q.5: Find x in the following proportions :

(i) $x : 56 :: 27 : 84$ (ii) $x : 17 :: 34 : 289$

(iii) $x : \frac{3}{7} :: \frac{8}{9} : \frac{36}{35}$ (iv) $x : 3.7 :: 8.5 : 1.7$

Ans. (i) $x : 56 :: 27 : 84$

As Product of extremes = Product of means

Then $84x = 56 \times 27$

$$\Rightarrow x = \frac{56 \times 27}{84} = \frac{4 \times 27}{6} = \frac{2 \times 27}{3} = 2 \times 9 = 18$$

(ii) $x : 17 :: 34 : 289$

As Product of extremes = Product of means

Then $289x = 17 \times 34$

$$\Rightarrow x = \frac{17 \times 34}{289} = \frac{34}{17} = 2$$

(iii) $x : \frac{3}{7} :: \frac{8}{9} : \frac{36}{35}$

As Product of extremes = Product of means

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$$\text{Then } \frac{36}{35}x = \frac{3}{7} \times \frac{8}{9}$$

$$\Rightarrow x = \frac{8}{21} \times \frac{35}{36} = \frac{2}{3} \times \frac{5}{9} = \frac{10}{27}$$

$$(iv) x : 3.7 :: 8.5 : 1.7$$

As Product of extremes = Product of means

$$\text{Then } 1.7x = 3.7 \times 8.5$$

$$\Rightarrow x = \frac{31.45}{1.7} = 18.5$$

Q.6: Find x in the following proportions :

$$(i) 16 : x :: x : 9 \quad (ii) 37.5 : x :: x : 1.5$$

$$(iii) \frac{8}{3} : x :: x : \frac{2}{27} \quad (iv) 288 : x :: x : 8$$

Ans: (i) $16 : x :: x : 9$

As Product of means = Product of extremes

$$\text{Then } x \times x = 16 \times 9$$

$$\Rightarrow x^2 = 144 \quad \text{Take square root of both sides}$$

$$\Rightarrow \sqrt{x^2} = \sqrt{144} \Rightarrow x = 12$$

(ii) $37.5 : x :: x : 1.5$

As Product of means = Product of extremes

$$\text{Then } x \times x = 37.5 \times 1.5$$

$$\Rightarrow x^2 = 56.25 \Rightarrow x^2 = \frac{5625}{100}$$

$$\Rightarrow x^2 = \left(\frac{75}{10}\right)^2 \quad \text{Take square root of both sides}$$

$$\Rightarrow \sqrt{x^2} = \sqrt{\left(\frac{75}{10}\right)^2} \Rightarrow x = \frac{75}{10} = 7.5$$

(iii) $\frac{8}{3} : x :: x : \frac{2}{27}$

As Product of means = Product of extremes

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$$\text{Then } x \times x = \frac{8}{3} \times \frac{2}{27} \Rightarrow x^2 = \frac{16}{81}$$

$$\Rightarrow x^2 = \left(\frac{4}{9}\right)^2 \quad \text{Take square root of both sides}$$

$$\Rightarrow \sqrt{x^2} = \sqrt{\left(\frac{4}{9}\right)^2} \Rightarrow x = \frac{4}{9}$$

(iv) $288 : x :: x : 8$

As Product of means = Product of extremes

$$\text{Then } x \times x = 288 \times 8$$

$$\Rightarrow x^2 = 2304 \Rightarrow x^2 = (48)^2$$

Take square root of both sides

$$\Rightarrow \sqrt{x^2} = \sqrt{(48)^2} \Rightarrow x = 48$$

Direct proportion: The relationship between two ratios in which increase in one quantity causes a proportional increase in the second quantity or decrease in one quantity results in a proportional decrease in the second quantity is called direct proportional.

If $a : b :: c : d$ is a direct proportional then $ad = bc$.

EXERCISE 1.6:

Q.1: The cost of 15 eggs is Rs. 75 . How much 3 dozens eggs Will cost ? .

Ans. The number of eggs are increased then the price is also increases . Then it is direct proportion .

Let the required price = x .

Numbers of eggs	Price
15	75
$3 \times 12 = 36$	x

$$\text{Then } 15 : 36 :: 75 : x$$

As Product of extremes = Product of means

$$\text{Then } 15x = 36 \times 75$$

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$$\Rightarrow x = \frac{36 \times 75}{15} = 36 \times 5 = 180$$

Q.2: A coaster covers a distance of 495 km in 9 hours .
 How much distance will it cover in 12 hours if there is
 no change in the speed of the coaster .

Ans. Let the distance covered by the coaster = x km

Distance	Time
495 km	9 h
x km	12 h

Then $495 : x :: 9 : 12$

As Product of means = Product of extremes

Then $9x = 12 \times 495$

$$\Rightarrow x = \frac{12 \times 495}{9} = 12 \times 55 = 660 \text{ km}$$

Q.3: A machine can check 1575 papers in 45 minutes . How
 much time will it take to check 8400 papers with the
 same speed ?.

Ans. Let required time = x minutes

Number of papers	time
1575	45 minutes
8400	x

Then $1575 : 8400 :: 45 : x$

As Product of extremes = Product of means

Then $1575x = 8400 \times 45$

$$\Rightarrow x = \frac{8400 \times 45}{1575} = \frac{378000}{1575} = 240 \text{ minutes .}$$

Q.4: At 2.00 pm shadow of Waseem was 81 cm and
 shadow of a nearby tree was 180 cm . If Waseem is
 157.5 cm tall , find the height of the tree .

Ans: Let height of the tree = x cm

Waseem shadow	Length of Tree shadow
81	180
157.5	x

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Then $81 : 157.5 :: 180 : x$

As Product of extremes = Product of means

Then $81x = 157.5 \times 180$

$$\Rightarrow x = \frac{28350}{81} = 350 \text{ cm.}$$

Q.5: Feroz wanted to purchase a toy helicopter . His mother gave him Rs. 100 and asked him to save the remaining amount from his pocket money . After 12 days , he found that he had saved Rs. 85 . In how much time will he be able to purchase the toy costing Rs. 270 , if he keeps on saving at the same rate .

Ans. Toy costing rate = Rs . 270

Given amount = Rs . 100

Remaining amount = $270 - 100 = 170$

Let x be the required number of days .

Number of days	amount
----------------	--------

12	85
----	----

x	170
-----	-----

$12 : x :: 85 : 170$

As Product of means = Product of extremes

Then $85x = 12 \times 170$

$$\Rightarrow x = \frac{12 \times 170}{85} = 12 \times 2 = 24 \text{ days}$$

Q.6: In a printing press , 4400 copies of a newspaper were Printed in 55 minutes . How long will the press take to Print 70 ,000 copies of a newspaper ? .

Ans. Time (in minutes) Number of copies

55	4400
----	------

x	70 , 000
-----	----------

Then $55 : x :: 4400 : 70000$

As Product of means = Product of extremes

Then $4400x = 55 \times 70000$

$$\Rightarrow x = \frac{55 \times 70000}{4400} = 875 \text{ minutes .}$$

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Q. 7. In one of the public schools , 19 teachers were appointed to teach 475 students . How many teachers will have to be appointed on the same ratio in another public school where where students enrolment is 1650 .

Ans.	Number of teachers	Number of students
	19	475
	x	1650

Then $19 : x :: 475 : 1650$

As Product of means = Product of extremes

Then $475x = 19 \times 1650$

$$\Rightarrow x = \frac{19 \times 1650}{475} = 66 \text{ Teachers.}$$

Q.8: In a field 50 m long and 30 m wide 6000 sapling were planted . If the area per sapling be kept the same , how many saplings can be planted in a field having an area of 4650 m^2 .

Ans. Area of the given field = $50 \times 30 = 1500 \text{ m}^2$

Number of plants = 6000 .

Let the number of plants in area 4650 m^2 is = x

Then	area	number of plants
	1500	6000
	4650	x

Then $1500 : 4650 :: 6000 : x$

As Product of extremes = Product of means

Then $1500x = 4650 \times 6000$

$$\Rightarrow x = \frac{4650 \times 6000}{1500} = 4650 \times 4 = 18600 \text{ plants.}$$

Q.9: In a hostel , 11.25 kg rice is cooked for the dinner of 90 boarders . If the scale remains the same , how much rice would be required for 372 boarders residing in the hostel ? .

Ans. Let the required rice for 372 boarders is = x

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Number of students	Rice (in kg)
90	11.25
372	x

Then $90 : 372 :: 11.25 : x$

As Product of extremes = Product of means

Then $90x = 372 \times 11.25$

$$\Rightarrow x = \frac{372 \times 11.25}{90} = 46.5 \text{ Kg .}$$

Q.10: A cyclist traveled 10 km in 16 minutes . Marinating the same speed , how much distances would he travel in 24 minutes ? .

Ans. Let the required distance traveled is = x

Time (in Minutes)	Distance (in km)
16	10
24	x

Then $16 : 24 :: 10 : x$

As Product of extremes = Product of means

Then $16x = 24 \times 10$

$$\Rightarrow x = \frac{240}{16} = 15 \text{ km .}$$

Inverse proportion : The relationship between two ratios in which increase in one quantity causes a proportional decrease in the second quantity or decrease in one quantity results in a proportional increase in the second quantity is called inverse proportion. If a , b and c , d are two quantities which are inverse proportion then we write in the ratio as
 $a : b :: d : c$ or $b : a :: c : d$
 then $ac = bd$.

Exercise 1.7:

Q.1: A car is traveling at an average speed of 60 km / hr and covers a distance in 8 hours 10 minutes . If the same distance is to be covered in 7 hours , what should be

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the average speed of the car ? .

Ans. As with time decreasing the speed is increase . Then it is inverse proportion .

$$\text{As 8 hours and 10 minutes} = 8 + \frac{10}{60} = 8 + 0.1667 = 8.1667 \text{ hr}$$

Let the required average speed = x

Speed	time
60	8.1667
x	7

Then $60 : x :: 7 : 8.1667$

$$\Rightarrow 7x = 60 \times 8.1666$$

$$\Rightarrow x = \frac{490}{7} = 70 \text{ Km}$$

Q.2: 30 Soldiers in a bunker have enough food for 45 days .
 5 soldiers were shifted to another bunker . How long would the food last for the remaining soldiers .

Ans. Let food for 25 soldiers have = x days .

Soldiers	days
30	45
25	x

Since the proportion is inverse , then

$$30 : 25 :: x : 45$$

$$\Rightarrow 25x = 30 \times 45$$

$$\Rightarrow x = \frac{30 \times 45}{25} = \frac{6 \times 45}{5} = 6 \times 9 = 54 \text{ days}$$

Q.3: A contractor engaged 18 labourers to complete a Piece of work in 24 days . Due to some urgency , he shifted 6 labourers to another project . How long would it take the remaining labourers to complete the work ? .

Ans.

Let remaining 12 labourers to complete the work in = x days

Number of Labourers	days
18	24
12	x

Since the proportion is inverse , then

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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$$18 : 12 :: x : 24$$

$$\Rightarrow 12x = 18 \times 24$$

$$\Rightarrow x = \frac{18 \times 24}{12} = 18 \times 2 = 36 \text{ days}$$

Q.4: With a shortfall of 2700 MW . supply of electricity in urban areas was restricted to 16 hours per day . When shortfall remained 2400 MW , for how many hours per day would the electricity be available in urban areas ? .

Ans: Let per day the electricity be available in urban areas is = x hours .

Shortfall in electricity	Supply in electricity
2700	16
2400	x

Since the proportion is inverse , then

$$2700 : 2400 :: x : 16$$

$$\Rightarrow 2400x = 16 \times 2700$$

$$\Rightarrow x = \frac{16 \times 2700}{2400} = \frac{16 \times 27}{24} = 2 \times 9 = 18 \text{ Hours}$$

Q.5: Two threshers can complete threshing the yield of wheat at Akram,s farms in 6 hours . How many threshers would be required to complete the same work in 4 hours ? .

Ans. Let required number of threshers = x

Number of threshers	Time (in hours)
2	6
x	4

Since the proportion is inverse , then

$$2 : x :: 4 : 6$$

$$\Rightarrow 4x = 2 \times 6$$

$$\Rightarrow x = \frac{12}{4} = 3 \text{ threshers}$$

Q.6: A passenger train covers the distance between two Cities in 2 hours and 40 minutes at an average speed 30 km/ hr . An express train covers the same distance in 2 hours . Find the average speed per hour of the express train ? .

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Ans: Let average speed of express train = x km /hr

$$\text{As 2 hours and 40 minutes} = 2 + \frac{40}{60} = 2 + 0.6667$$

$$= 2.6667 \text{ hours .}$$

Average speed	Time (in hour)
30	2.6667
x	2

Since the proportion is inverse , then

$$30 : x :: 2 : 2.6667$$

$$\Rightarrow 2x = 2.6667 \times 30$$

$$\Rightarrow x = \frac{80}{2} = 40 \text{ km/hr}$$

Q.7: In a school hostel , food for 46 days was available for 360 boarders . 15 borders went on long leave. For how long the food will sufficient for the remaining borders .

Ans: Let food for 345 remaining boarders have = x days

boarders	days
360	46
345	x

Since the proportion is inverse , then

$$360 : 345 :: x : 46$$

$$\Rightarrow 345x = 360 \times 46$$

$$\Rightarrow x = \frac{360 \times 46}{345} = \frac{16560}{345} = 48 \text{ days}$$

Q.8: At a summer camp , arrangements were made for the boarding of 204 participants for 18 days .The number of participants increased by 12 .By how many days the programs should be curtailed so that the same arrangements could meet the need of the increased number of participants ?

Ans. Let the number of days = x

After increased in participants ,the total number of participants = $204 + 12 = 216$

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participants	days
204	18
216	x

Since the proportion is inverse , then

$$204 : 216 :: x : 18$$

$$\Rightarrow 216x = 204 \times 18$$

$$\Rightarrow x = \frac{3672}{216} = 17 \text{ days}$$

Q.9: A road was to be constructed by 85 labourers in 24 days . To complete the work in 20 days , how many labourers should be increased ?

Ans. Let number of required labourers = x

Number of Labourers	days
85	24
x	20

Since the proportion is inverse , then

$$85 : x :: 24 : 20$$

$$\Rightarrow 20x = 85 \times 24$$

$$\Rightarrow x = \frac{2040}{20} = 102 \text{ Labourers}$$

Thus number of increased in labourers = $102 - 85$
 $= 17 \text{ labourers .}$

Compound proportion : Relation between two or more proportions is known as compound proportion .

Exercise 1.8:

Q.1: Stay of 6 persons in a guest house for 4 nights costs Rs 19200 .What will be the cost , if 5 persons stay in the same guest house for 6 nights .

Ans. Let the required cost = x

Persons	nights	costs
6	4	19200
5	6	x

Now we compare persons with cost

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Persons	costs
6	19200
5	x

This is the direct proportion , then

$$6 : 5 :: 19200 : x \quad \dots\dots\dots(i)$$

Now we compare nights with costs .

Nights.	costs
4	19200
6	x

This is the direct proportion , then

$$4 : 6 :: 19200 : x \quad \dots\dots\dots(ii)$$

Now combined (i) and (ii) ,

$$\begin{array}{c} \text{Extremes} \\ \left[\begin{array}{c} 6 \\ 4 \end{array} \right] : \left[\begin{array}{c} 5 \\ 6 \end{array} \right] :: 19200 : x \\ \text{Means} \end{array}$$

Product of extremes = product of means

$$6 \times 4 \times x = 5 \times 6 \times 19200$$

$$\Rightarrow x = \frac{5 \times 6 \times 19200}{6 \times 4} = 5 \times 4800 = 24000$$

Thus the required cost Rs . 24000 .

Q.2: If 35 labourers earn an over time allowance of Rs. 8750 for working 5 hours extra , how much would 45 labourers earn if they work for three hours extra ?

Ans. Let the required allowance = x .

Labourers	time (in hours)	allowance
35	5	8750
45	3	x

Now we compare labourers with allowance

Labourers	allowance
35	8750
45	x

This is the direct proportion , then

$$35 : 45 :: 8750 : x \quad \dots\dots\dots(i)$$

Now we compare time with allowance .

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time	allowance
5	8750
3	x

This is the direct proportion , then

$$5 : 3 :: 8750 : x \quad \dots\dots\dots(ii)$$

Now combined (i) and (ii) ,

$$\left[\begin{array}{c} 35 \\ 5 \end{array} \right] : \left[\begin{array}{c} 45 \\ 3 \end{array} \right] :: 8750 : x$$

Extremes
Means

Product of extremes = product of means

$$35 \times 5 \times x = 45 \times 3 \times 8750$$

$$\Rightarrow x = \frac{1181250}{175} = 6750$$

Thus the required allowance Rs . 6750 .

Q.3: 15 tailors working 8 hours a day can stitch 60 shirts .

How many shirts will be stitched by 10 tailors while working 11 hours a day ?

Ans. Let the required number of shirts = x

Tailors	Time (hours)	Shirts
15	8	60
10	11	x

Now we compare tailors with shirts

Tailors	shirts
15	60
10	x

This is the direct proportion , then

$$15 : 10 :: 60 : x \quad \dots\dots\dots(i)$$

Now we compare time with shirts .

time	shirts
8	60
11	x

This is the direct proportion , then

$$8 : 11 :: 60 : x \quad \dots\dots\dots(ii)$$

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Now combined (i) and (ii) ,

$$\begin{array}{c} \text{Extremes} \\ \left[\begin{array}{c} 15 \\ 8 \end{array} \right] : \left[\begin{array}{c} 10 \\ 11 \end{array} \right] :: 60 : x \\ \text{Means} \end{array}$$

Product of extremes = product of means

$$15 \times 8 \times x = 10 \times 11 \times 60$$

$$\Rightarrow x = \frac{6600}{120} = 55$$

Thus the required number of shirts = 55

Q.4: 16 masons can build a wall 4 m high in 5 days . What will be the height of the wall built by 10 masons in 4 days.

Ans: Let height of the wall = x m .

Masons	days	height
16	5	4
10	4	x

Now we compare Masons with height

Masons	height
16	4
10	x

This is the direct proportion , then

$$16 : 10 :: 4 : x \quad \dots\dots\dots(i)$$

Now we compare days with height .

days	height
5	4
4	x

This is the direct proportion , then

$$5 : 4 :: 4 : x \quad \dots\dots\dots(ii)$$

Now combined (i) and (ii) ,

$$\begin{array}{c} \text{Extremes} \\ \left[\begin{array}{c} 16 \\ 5 \end{array} \right] : \left[\begin{array}{c} 10 \\ 4 \end{array} \right] :: 4 : x \\ \text{Means} \end{array}$$

Product of extremes = product of means

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$$16 \times 5 \times x = 10 \times 4 \times 4$$

$$\Rightarrow x = \frac{160}{80} = 2$$

Thus the required height of the wall = 2 m .

Q.5: 10 men take 12 hours to spray insecticides on fruit trees spread over 40 hectares .How many men will be required to spray 32 hectares area in 8 hours ?

Ans. Let. the number of men = x

Time	hectares	men
12	40	10
8	32	x

Now we compare time with men

Time	Men
12	10
8	x

This is the inverse proportion , then

$$8 : 12 :: 10 : x \quad \dots\dots(i)$$

Now we compare hectares with men .

hectares	men
40	10
32	x

This is the direct proportion , then

$$40 : 32 :: 10 : x \quad \dots\dots(ii)$$

Now combined (i) and (ii) ,

$$\begin{array}{c} \text{Extremes} \\ \left[\begin{array}{c} 8 \\ 40 \end{array} \right] : \left[\begin{array}{c} 12 \\ 32 \end{array} \right] :: 10 : x \\ \text{Means} \end{array}$$

Product of extremes = product of means

$$8 \times 40 \times x = 12 \times 32 \times 10$$

$$\Rightarrow x = \frac{12 \times 320}{320} = 12$$

Thus the required of men = 12 .

Q.6: It took Maadeya 25 days to solve 150 sums of mathematics by working one hour daily during summer

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vacation . For how long she will have to work daily to complete 240 sums in 30 days (assuming the time taken for solving a sum remains the same) ?

Ans. Let the required time = x

Questions	days	time (minutes)
150	25	60
240	30	x

Now we compare questions with time

Questions	time
150	60
240	x

This is the direct proportion , then

$$150 : 240 :: 60 : x \quad \dots\dots\dots(i)$$

Now we compare days with time .

days	time
25	60
30	x

This is the inverse proportion , then

$$30 : 25 :: 60 : x \quad \dots\dots\dots(ii)$$

Now combined (i) and (ii) ,

$$\left[\begin{array}{c} 150 \\ 30 \end{array} \right] : \left[\begin{array}{c} 240 \\ 25 \end{array} \right] :: 60 : x$$

$\xrightarrow{\text{Extremes}}$
 $\xleftarrow{\text{Means}}$

Product of extremes = product of means

$$150 \times 30 \times x = 240 \times 25 \times 60$$

$$\Rightarrow x = \frac{240 \times 1500}{150 \times 30} = 8 \times 10 = 80$$

Thus the required time = 80 minutes .

Q.7: 20 persons consume 160 gallons drinking water in 40 days . In how many days 25 persons will consume 175 gallons drinking water .

Ans: Let the number of required days = x

Persons	gallons	days
20	160	40
25	175	x

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Now we compare persons with days

persons	days
20	40
25	x

This is the inverse proportion, then

$$25 : 20 :: 40 : x \quad \dots\dots\dots(i)$$

Now we compare gallons with days

gallons	days
160	40
175	x

This is the direct proportion, then

$$160 : 175 :: 40 : x \quad \dots\dots\dots(ii)$$

Now combined (i) and (ii),

$$\begin{array}{c} \text{Extremes} \\ \left[\begin{array}{c} 25 \\ 160 \end{array} \right] : \left[\begin{array}{c} 20 \\ 175 \end{array} \right] :: 40 : x \\ \text{Means} \end{array}$$

Product of extremes = product of means

$$25 \times 160 \times x = 20 \times 175 \times 40$$

$$\Rightarrow x = \frac{20 \times 175 \times 40}{25 \times 160} = 5 \times 10 = 50$$

Thus the required days = 50 .

Q.8: 20 Employees get Rs 85000 for 17 days by working 8 hours a day . In how many employees will get Rs . 62500 for 25 days work ? .

Ans. Let the number of employees = x

Days	money (Rs)	Employees
17	85000	20
25	62500	x

Now we compare employees with money

Money	Employees
85000	20
62500	x

This is the direct proportion, then

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$$85000 : 62500 :: 20 : x \quad \dots\dots(i)$$

Now we compare employees with days .

Days	Employees
17	20
25	x

This is the inverse proportion , then

$$25 : 17 :: 20 : x \quad \dots\dots(ii)$$

Now combined (i) and (ii) ,

$$\left[\begin{array}{c} 85000 \\ 25 \end{array} \right] : \left[\begin{array}{c} 62500 \\ 17 \end{array} \right] :: 20 : x$$

$\xrightarrow{\text{Extremes}}$
 $\xleftarrow{\text{Means}}$

Product of extremes = product of means

$$85000 \times 25 \times x = 62500 \times 17 \times 20$$

$$\Rightarrow x = \frac{62500 \times 17 \times 20}{85000 \times 25} = \frac{2500 \times 20}{5000}$$

$$= \frac{20}{2} = 10$$

Thus the required employees are = 10 .

Q.9: 10 women can will weave a carpet in 18 days by working 8 hours a day . In how many days will 12 women weave the same carpet if they work 5 hours daily.

Ans: Let the number of required days = x

Women	hours	days
10	8	18
12	5	x

Now we compare women with days

Women	days
10	18
12	x

This is the inverse proportion , then

$$12 : 10 :: 18 : x \quad \dots\dots(i)$$

Now we compare hours with days .

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Hours	days
8	18
5	x

This is the inverse proportion , then

$$5 : 8 :: 18 : x \quad \dots\dots(ii)$$

Now combined (i) and (ii) ,

$$\left[\begin{array}{c} 12 \\ 5 \end{array} \right] : \left[\begin{array}{c} 10 \\ 8 \end{array} \right] :: 18 : x$$

Extremes
Means

Product of extremes = product of means

$$12 \times 5 \times x = 10 \times 8 \times 18$$

$$\Rightarrow x = \frac{10 \times 8 \times 18}{12 \times 5} = \frac{1440}{60} = 24$$

Thus the required days = 24

Q.10: 45 prisoners can construct a barrack in 40 days by working 7 hours daily . How many days will be required if 35 prisoners work for 8 hours daily ? .

Ans: Let the number of required days = x

Prisoners	hours	days
45	7	40
35	8	x

Now we compare prisoners with days

prisoners	days
45	40
35	x

This is the inverse proportion , then

$$35 : 45 :: 40 : x \quad \dots\dots(i)$$

Now we compare hours with days

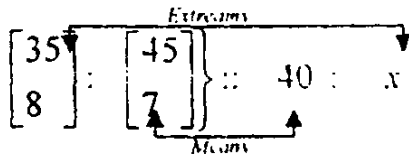
Hours	days
7	40
8	x

This is the inverse proportion , then

$$8 : 7 :: 40 : x \quad \dots\dots(ii)$$

Now combined (i) and (ii) ,

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)



Product of extremes = product of means

$$35 \times 8 \times x = 45 \times 7 \times 40$$

$$\Rightarrow x = \frac{45 \times 7 \times 40}{35 \times 8} = \frac{12600}{280} = 45$$

Thus the required days = 45

Q.11: 3600 Tiles of 25 cm length and 12 cm width are needed for a courtyard . How many square shaped tiles will be needed to cover the same courtyard if one side of the tile is 20 cm long ? .

Ans: Let the number of required tiles = x

Length	width	tilles
25	12	3600
20	20	x

Now we compare length with tiles

length	tiles
25	3600
20	x

This is the inverse proportion , then

$$20 : 25 :: 3600 : x \dots\dots\dots(i)$$

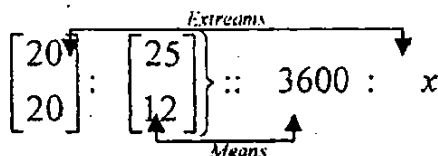
Now we compare width with tiles

Width	tiles
12	3600
20	x

This is the inverse proportion , then

$$20 : 12 :: 3600 : x \dots\dots\dots(ii)$$

Now combined (i) and (ii) ,



Product of extremes = product of means

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$$20 \times 20 \times x = 25 \times 12 \times 3600$$

$$\Rightarrow x = \frac{25 \times 12 \times 3600}{20 \times 20} = 25 \times 12 \times 9 = 2700$$

Thus the required tiles = 2700

Q.12: 7 excavators working daily for 8 hours can dig a site in 3 days. How many excavators will be needed to dig the same site in 2 days by working 6 hours a day?

Ans: Let the number of excavators = x

Days	hours	excavators
3	8	7
2	6	x

Now we compare days with excavators

days	excavators
3	7
2	x

This is the inverse proportion, then

$$2 : 3 :: 7 : x \quad \dots\dots\dots(i)$$

Now we compare hours with excavators.

hours	excavators
8	7
6	x

This is the inverse proportion, then

$$6 : 8 :: 7 : x \quad \dots\dots\dots(ii)$$

Now combined (i) and (ii),

$$\begin{array}{c} \text{Extremes} \\ \left[\begin{array}{c} 2 \\ 6 \end{array} \right] : \left[\begin{array}{c} 3 \\ 8 \end{array} \right] :: 7 : x \\ \text{Means} \end{array}$$

Product of extremes = product of means

$$2 \times 6 \times x = 3 \times 8 \times 7$$

$$\Rightarrow x = \frac{168}{12} = 14$$

Thus the required excavators are = 14.

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Exercise 1.9 (Objective Questions)

Q.1: Read the following statements carefully . Encircle "T"

If the statement is true and "F" in case it is wrong .

- (i) 85 % , when converted into common fraction is written as 0.85 T / F
- (ii) 64 % when converted into decimal fraction is written as 0.64 . T / F
- (iii) $\frac{7}{8}$ is converted into percentage is written as $87\frac{1}{2}$ % T / F
- (iv) 135 % when converted into decimal fraction is written as 0.135 . T / F
- (v) 0.006 is converted into percentage is written as 60 % T / F
- (vi) Ratio between 81 Rupees 45 Rupees is 9 : 5 T / F
- (vii) 2 : 5 :: 4 : 7 is a proportion T / F
- (viii) If 3 : 2 :: 18 : x is a proportion when x = 12 T / F

Answers: (i) F (ii) T (iii) T (iv) F (v) F
(vi) T (vii) F (viii) T

Q.2: Four suggested answers are given for each question .

Select the correct answer and write the corresponding letter (i.e. a , b , c , d) in the block , given in front of the question .

- (i) 60% =
(a) $\frac{5}{3}$ (b) 6 (c) 60 (d) $\frac{3}{5}$
- (ii) $\frac{1}{8}$ =
(a) 37.5 % (b) 1.25% (c) 12.5% (d) 0.8%
- (iii) $2\frac{3}{4}$ =

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- (a) 2.75% (b) 27.5% (c) 275% (d) 0.275%
- (iv) Aslam got marks 680 out of 850 in annual examination .
What percentage of marks did he got
(a) 68% (b) 85% (c) 80% (d) 70%
- (v) Ratio between 9 kilograms and 18 grams in simplest form is (a) 1 : 2 (b) 500 : 1
(c) 50 : 1 (d) Ratio can not be established
- (vi) Which of the following is a proportion .
(a) 2 : 3 :: 4 : 5 (b) 12 : 2 :: 18 : 3
(c) 9 : 4 :: 12 : 3 (d) all of the above .
- (vii) If $x : 5 :: 9 : 11.25$ is a proportion , then $x = \dots\dots$
(a) 45 (b) 11.25 (c) 2 (d) 4
- (viii) Relationship between two or more proportions is called
(a) Compound proportion (b) Direct proportion
(c) Inverse proportion (d) Non of these
- (ix) If $a : b :: c : d$ is a proportion , then
(a) $ab = cd$ (b) $a + b = b + c$
(c) $ad = bc$ (d) $a - d = b - c$
- (x) In $2 : x :: x : 18$, x is called :
(a) extreme (b) mean proportional
(c) 3rd proportional (d) fourth proportional
- Answers:** (i) d (ii) c (iii) c (iv) c (v) b
(vi) b (vii) d (viii) a (ix) c (x) b

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

Unit -2

Zakat, Ushar and Inheritance.

$$\text{Rate of Zakat} = 2.5 \% = \frac{2.5}{100} = \frac{25}{1000} = \frac{1}{40}$$

Exercise 2.1 :

Q.1: Find the amount of Zakat payable on the following assets .

- (i) Cash of Rs. 75,000.
- (ii) Jewellery worth Rs. 175, 000 and cash of Rs. 95000
- (iii) Gold ornaments worth Rs. 150 ,000 , silver utensils worth Rs 51,250 and cash of Rs . 150 ,000 .

Solution: (i) Rate of Zakat = 2.5 %

$$\begin{aligned} &= \frac{2.5}{10} \times \frac{1}{100} \\ &= \frac{1}{40} \end{aligned}$$

$$\text{Zakat on Rs 75000} = 75000 \times \frac{1}{40} = \text{Rs } 1875$$

Thus Zakat on Rs 75000 is Rs 1875 .

(ii) value of Jewellery = Rs 175 ,000

Cash = 95000 .

$$\begin{aligned} \text{Total amount} &= 175, 000 + 95000 \\ &= \text{Rs } 270000 . \end{aligned}$$

Rate of Zakat = 2.5 %

$$\begin{aligned} &= \frac{2.5}{10} \times \frac{1}{100} \\ &= \frac{1}{40} \end{aligned}$$

$$\text{Zakat on Rs 270000} = 270000 \times \frac{1}{40} = \text{Rs } 6750$$

Thus Zakat on Rs 270000 is Rs 6750 .

(iii) value of gold ornaments = Rs. 135 , 000

Value of silver utensils = Rs. 51,250

Cash = 150,000 .

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$$\begin{aligned}\text{Total amount} &= 135,000 + 51,250 + 150,000 \\ &= \text{Rs } 336,250\end{aligned}$$

$$\text{Rate of Zakat} = 2.5 \%$$

$$\begin{aligned}&= \frac{2.5}{10} \times \frac{1}{100} \\ &= \frac{1}{40}\end{aligned}$$

$$\text{Zakat on Rs } 336,250 = 336,250 \times \frac{1}{40} = \text{Rs } 8406.25$$

Thus Zakat on Rs 336,250 is Rs 8406.25

Q.2: Shehnaz paid Rs. 6250 as Zakat on her jewellery .

Find the value of her jewellery .

Solution: Suppose the required amount = x rupees .

Zakat paid = Rs.6250 .

Rate of Zakat = 2.5 %

$$\begin{aligned}&= \frac{2.5}{10} \times \frac{1}{100} \\ &= \frac{1}{40}\end{aligned}$$

$$\text{Then } \frac{1}{40} \times x = 6250$$

$$\Rightarrow x = 6250 \times 40 = 250000$$

Thus required amount = 250000 rupees .

Q.3: Abid paid Rs. 4925 as Zakat .Find his saving .

Solution: Suppose the required amount = x rupees .

Zakat paid = Rs.4925 .

Rate of Zakat = 2.5 %

$$\begin{aligned}&= \frac{2.5}{10} \times \frac{1}{100} \\ &= \frac{1}{40}\end{aligned}$$

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$$\text{Then } \frac{1}{40} \times x = 4925$$

$$\Rightarrow x = 4925 \times 40 = 197000$$

Thus required amount = 197000 rupees .

Q.4: Asif paid Rs. 5840 as Zakat on trade goods and cash amount that he possessed for one year .If the trade goods were worth Rs. 170,000 , find the cash amount he had .

Solution: Value of goods = 170 , 000 .

Suppose the total amount = x rupees

Zakat paid = Rs.5840 .

Rate of Zakat = 2.5 %

$$\begin{aligned} &= \frac{2.5}{10} \times \frac{1}{100} \\ &= \frac{1}{40} \end{aligned}$$

$$\text{Then } \frac{1}{40} \times x = 5840$$

$$\Rightarrow x = 5840 \times 40 = 233600$$

Thus the cash amount = 233600 – 170000
= 63600 rupees .

Q.5: Abida paid Rs.7755 as Zakat on her gold ornaments . If the rate of gold is Rs . 28200 per tola . How much Gold ornaments she had .

Solution : Suppose the total amount = x rupees ,

Zakat paid = Rs.7755 .

Rate of Zakat = 2.5 %

$$\begin{aligned} &= \frac{2.5}{10} \times \frac{1}{100} \\ &= \frac{1}{40} \end{aligned}$$

$$\text{Then } \frac{1}{40} \times x = 7755$$

$$\Rightarrow x = 7755 \times 40 = 310200$$

As one tola rate = Rs. 28200

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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$$\begin{aligned}\text{Then Abida had gold ornaments} &= \frac{310200}{28200} \\ &= 11 \text{ tola}\end{aligned}$$

Q.6: Shireen had 80gms gold and 520 gm ornaments .
 She had a cash amount of Rs. 200 ,000 as well . Calculate
 the Zakat payable by her if the rate of gold is 3425
 rupees per gram and that of silver is 35 rupees per
 gram .

Solution : As 1 gm of gold rate = 3425 rupees

$$\begin{aligned}80 \text{ gm of gold rate} &= 80 \times 3425 \\ &= 274000 \text{ rupees .}\end{aligned}$$

As 1 gm of silver rate = 35 rupees

$$\begin{aligned}520 \text{ gm of gold rate} &= 520 \times 35 \\ &= 18200 \text{ rupees}\end{aligned}$$

cash amount of = 200 ,000 rupees

$$\begin{aligned}\text{Thus total amount} &= 274000 + 18200 + 200,000 \\ &= 492200 \text{ rupees .}\end{aligned}$$

Rate of Zakat = 2.5 %

$$\begin{aligned}&= \frac{2.5}{10} \times \frac{1}{100} \\ &= \frac{1}{40}\end{aligned}$$

$$\text{Then total Zakat paid} = \frac{1}{40} \times 492200 = 12305 \text{ rupees}$$

Q.7: Sehba had 8 tola gold and some silver ornaments.

She paid Rs. 5932.50 as Zakat . If the rate of gold per
 tola Rs. 28200 and silver per tola is Rs. 390 . Find
 how much silver ornaments did she possess ? .

Solution: Suppose the total amount = x rupees .

Zakat paid = 5932.50 rupees .

Rate of Zakat = 2.5 %

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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$$\begin{aligned} &= \frac{2.5}{10} \times \frac{1}{100} \\ &= \frac{1}{40} \end{aligned}$$

Then $\frac{1}{40} \times x = 5932.50$

$\Rightarrow x = 5932.50 \times 40 = 237300$ rupees.

As one tola rate of gold = 28200 rupees .

8 tola rate of gold = 8×28200
 $= 225600$ rupees .

Silver amount = $237300 - 225600$
 $= 11700$ rupees .

As per tola amount of silver = 390 rupees .

Then Sehba had silver ornaments = $\frac{11700}{390}$
 $= 30$ tola

Q.8: Naureen paid Rs. 4890 as zakat . She had Rs.50000 cash and some jewellery . Find the value of of her jewellery .

Solution: Suppose the total amount = x rupees .

Zakat paid = 4890 rupees .

Rate of Zakat = 2.5 %

$$\begin{aligned} &= \frac{2.5}{10} \times \frac{1}{100} \\ &= \frac{1}{40} \end{aligned}$$

Then $\frac{1}{40} \times x = 4890$

$\Rightarrow x = 4890 \times 40 = 195600$ rupees.

Amount of jewellery = $195600 - 50000$
 $= 145600$ rupees .

Q.9: Hafeez had trade goods worth Rs. 175000 and a cash amount of Rs. 90, 000 . If his wife possessed jewellery worth Rs. 84000 , find the amount of Zakat payable

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by him .

Solution: Goods worth = 175000 rupees .

Jewellery values = 84000 rupees

cash amount of = 90,000 rupees

Thus total amount = 175000 + 84000 + 90,000

= 349000 rupees .

Rate of Zakat = 2.5 %

$$= \frac{2.5}{10} \times \frac{1}{100}$$

$$= \frac{1}{40}$$

Then total Zakat paid = $\frac{1}{40} \times 349000 = 8725$ rupees

USHR: Zakat on Agriculture produce i.e. crops fruits ,
vegetables is called Ushr .

If labors needed for irrigation then the rate of ushr

10 % and If labors not needed for irrigation then

the rate of ushr 5 % .

Exercise, 2.2:

Q.1: Ubaid owned 24 jarib barani land . Average yield
during one harvest seasons was 750 kg per jarib .

How much crop did he get in the season ? How much

Ushr will he pay if the market value of the crop was

Rs. 500 per 40 kg ? .

Solution: Total barani land = 24 jarib

Average crop yield per jarib = 750 kg

Total crops yield = $24 \times 750 = 18000$ kg

Market value of 40 kg crops = 500 rupees

Market value of 18000 kg crops = $18000 \times \frac{500}{40} = 45 \times 500$
= 225000 rupees

Rate of Ushr = 10 % = $\frac{10}{100} = \frac{1}{10}$

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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$$\text{Ushr paid} = \frac{1}{10} \times 225000 = 22500 \text{ rupees.}$$

Q.2: Agricultural lands of a village were irrigated through a canal . A landlord owned 400 jarib land and cultivated sugarcane in it . He got an average harvest of 800 kg per jarib . A sugar mill purchased the sugar can Rs. 120 per 40 kg . How much did he earn ? How much Ushr he will have to pay ?

Solution: Total land = 400 jarib

Average crop yield per jarib = 800 kg

Total crops yield = $400 \times 800 = 320000$ kg

Market value of 40 kg sugar = 120 rupees

$$\begin{aligned} \text{Market value of } 320000 \text{ kg crops} &= 320000 \times \frac{120}{40} \\ &= 8000 \times 120 \\ &= 960000 \text{ rupees} \end{aligned}$$

$$\text{Rate of Ushr} = 5\% = \frac{5}{100} = \frac{1}{20}$$

$$\text{Ushr paid} = \frac{1}{20} \times 960000 = 48000 \text{ rupees.}$$

Q.3: Due to timely rains , Muhammad Nasir got an excellent yield of wheat . Food department purchased the whole crop Rs. 490 per 40 kg . Muhammad Nasir was paid Rs. 156,800 for the crop .How much Ushr he will have to pay ? What was his total yield ? How much land did he own if average yield per jarib was 800 kg ? .

Solution: Total amount = 156,800 rupees

40 kg crops rate = 490 rupees

Let total yield = x kg

$$\frac{x}{40} \times 490 = 156,800$$

$$\Rightarrow x = \frac{40}{490} \times 156,800 = \frac{6272000}{490} = 12800 \text{ kg}$$

Thus Muhammad Nasir got total yield = 12800 kg .

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$$1 \text{ jarib yield} = 800 \text{ kg}$$

$$\text{Toal land} = \frac{12800}{800} = 16 \text{ jarib .}$$

Muhammad Nasir has 16 jarib land .

$$\text{Rate of Ushr} = 10 \% = \frac{10}{100} = \frac{1}{10}$$

$$\text{Ushr paid} = \frac{1}{10} \times 156,800 = 15680 \text{ rupees .}$$

Q.4: Fahad paid Rs. 11125 as Ushr in lieu of the payment he received for the sale of his maize crop from the trading corporation of Pakistan .If the irrigation source of his lands was rain , find out how much did he earn from the crop ?

Solution: supposed total earn = x rupees

$$\text{Ushr paid} = 11125 \text{ rupees}$$

$$\text{Rate of Ushr} = 10 \% = \frac{10}{100} = \frac{1}{10} .$$

$$\text{Then } x \times \frac{1}{10} = 11125$$

$$\Rightarrow x = 10 \times 11125 = 111250$$

Thus total earn = 111250 rupees .

Q.5: A farmer got 1600 kg of gur from the sugarcane harvest . If 5 kg of gur is prepared from 40 kg of sugarcane , find his yield of sugarcane . Also calculate Ushr he has to pay if the irrigation source is the tube well and he sold the gur in open market at the rate of Rs . 1500 per 40 kg .

Solution: Total gur = 1600 kg

Value of gur = 1500 rupees per 40 kg .

$$\begin{aligned} \text{Then total value of gur} &= \frac{1500}{40} \times 1600 \\ &= 1500 \times 40 = 60000 \end{aligned}$$

Since the irrigation is tub well then Rate of Ushr = 5 %

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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$$\text{Ushr paid} = \frac{5}{100} \times 60000 = 5 \times 600 = 3000 \text{ rupees .}$$

Supposed yield of sugarcane = x kg
5 kg gur required = 40 kg sugarcane

$$\text{Then } x = \frac{40}{5} \times 1600 = 8 \times 1600 = 12800$$

Thus total sugar cane = 12800 kg .

Q.6: Ikram got 80 tons of apples from his farms irrigated through tube wells and sold it to the export trading corporation Rs. 1800 per 40 kg . Calculate the Ushr he has to pay ?

Solution: Total apples = 80 tons .

Since 1 ton = 1000 kg

Then total apples = $80 \times 1000 = 80000$ kg .

Rate of sale = 1800 rupees per 40 kg .

$$\begin{aligned} \text{Then total amount} &= \frac{1800}{40} \times 80000 \\ &= 45 \times 80000 = 3600000 \text{ rupees} \end{aligned}$$

Since the irrigation is tub well then Rate of Ushr = 5 %

$$\text{Ushr paid} = \frac{5}{100} \times 3600000 = 5 \times 36000 = 180000 \text{ rupees .}$$

Inheritance : When a Muslim dies and leaves behind any type of property is called Inheritance .

Exercise 2.3:

Q.1: A person died and left behind assets Rs. 560,000 . After spending Rs. 8000 on burial and cleaning his debt Rs.112,000 the remaining amount was distributed among his widow , 3 sons and 4 daughters in such a manner that widow got $\frac{1}{8}$ th of the reaming amount and each son got double of the share of the daughter . Find the share of each heir .

Solution: Total assets = 560,000 rupees .

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Amount Spending on burial = 8000 rupees

Amount on debt = 112,000 .

Remaining amount = $560,000 - (8000 + 112,000)$
 $= 560,000 - 120,000$
 $= 440,000$ rupees

Share of Widow = $\frac{1}{8} \times 440,000 = 55,000$ rupees .

Remaining amount = $440,000 - 55,000$
 $= 385,000$ rupees .

Number of sons = 3

Number of daughters = 4

Son has 2 share and daughter has 1 share .

Then sum of ratio = $3 \times 2 + 4 \times 1 = 6 + 4 = 10$

Share of each son = $\frac{2}{10} \times 385,000$
 $= 2 \times 38,500 = 77,000$ rupees.

Share of each daughter = $\frac{1}{10} \times 385,000$
 $= 38,500$ rupees.

Q.2: A woman passed away leaving behind assets of Rs. 391,240 . According to her will , Rs. 100,000 were donated to a Cancer Hospital and the remaining amount was distributed among her husband , two sons and one daughter . If the husband got $\frac{1}{4}$ of the

amount and the remaining went to children in such manner that the ratio between the share of a son and a daughter was 2 : 1 , then find the share of each heir.

Solution: Total assets = 391,240 rupees .

Amount denoted = 100,000 .

Remaining amount = $391,240 - 100,000$
 $= 291,240$ rupees

Share of husband = $\frac{1}{4} \times 291,240 = 72,810$ rupees .

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$$\begin{aligned}\text{Remaining amount} &= 291,240 - 72810 \\ &= 218430 \text{ rupees.}\end{aligned}$$

$$\text{Number of sons} = 2$$

$$\text{Number of daughters} = 1$$

Son has 2 share and daughter has 1 share.

$$\text{Then sum of ratio} = 2 \times 2 + 1 \times 1 = 4 + 1 = 5$$

$$\begin{aligned}\text{Share of each son} &= \frac{2}{5} \times 218430 \\ &= 2 \times 87372 = 174744 \text{ rupees.}\end{aligned}$$

$$\begin{aligned}\text{Share of each daughter} &= \frac{1}{5} \times 218430 \\ &= 43686 \text{ rupees.}\end{aligned}$$

Q.3: A person died and left behind assets worth Rs. 432,880 . Rs. 100,000 were spent on his burial . Divided the remaining amount among his widow whose

Share is $\frac{1}{8}$ of the amount and a son , a daughter in the ratio of 2 : 1 .

Solution: Total assets = 432,880 rupees .

Amount Spending on burial = 100,000 rupees

$$\begin{aligned}\text{Remaining amount} &= 432,880 - 100,000 \\ &= 332,880 \text{ rupees}\end{aligned}$$

$$\text{Share of Widow} = \frac{1}{8} \times 332880 = 41610 \text{ rupees.}$$

$$\begin{aligned}\text{Remaining amount} &= 332,880 - 41610 \\ &= 291270 \text{ rupees.}\end{aligned}$$

$$\text{Number of sons} = 1$$

$$\text{Number of daughters} = 1$$

Son has 2 share and daughter has 1 share.

$$\text{Then sum of ratio} = 1 \times 2 + 1 \times 1 = 2 + 1 = 3$$

$$\begin{aligned}\text{Share of each son} &= \frac{2}{3} \times 291270 \\ &= 2 \times 97090 = 194180 \text{ rupees.}\end{aligned}$$

$$\text{Share of each daughter} = \frac{1}{3} \times 291270$$

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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= 97090 rupees.

Q.4: A person left behind assets worth Rs. 336,830 on his death . A debt of Rs. 140 ,000 was payable by him to a bank . Remaining amount was distributed among his widow ,mother , father and two daughters in the ratio of $\frac{1}{8} : \frac{1}{6} : \frac{1}{6} : \frac{2}{3}$. Find the share of each .

Sol: Total assets = 336,830 rupees

Amount on debt = 140,000 rupees

Remaining mount = 336, 830 – 140000

= 196830 rupees

widow mother : father : daughters

$$\frac{1}{8} : \frac{1}{6} : \frac{1}{6} : \frac{2}{3}$$

$$\begin{aligned} \text{Sum of ratios} &= \frac{1}{8} + \frac{1}{6} + \frac{1}{6} + \frac{2}{3} \\ &= \frac{3+4+4+16}{24} = \frac{27}{24} \\ &= \frac{9}{8} \end{aligned}$$

$$\begin{aligned} \text{Share of widow} &= \frac{1/8}{9/8} \times 196830 \\ &= \frac{1}{8} \times \frac{8}{9} \times 196830 \\ &= 21870 \text{ rupees .} \end{aligned}$$

$$\begin{aligned} \text{Share of mother} &= \frac{1/6}{9/8} \times 196830 \\ &= \frac{1}{6} \times \frac{8}{9} \times 196830 \\ &= \frac{4}{3} \times 21870 = 29160 \text{ rupees .} \end{aligned}$$

$$\text{Share of father} = \frac{1/6}{9/8} \times 196830$$

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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$$= \frac{1}{6} \times \frac{8}{9} \times 196830$$

$$= \frac{4}{3} \times 21870 = 29160 \text{ rupees.}$$

$$\text{Share of daughters} = \frac{2/3}{9/8} \times 196830$$

$$= \frac{2}{3} \times \frac{8}{9} \times 196830$$

$$= 16 \times 7290 = 116140 \text{ rupees.}$$

$$\text{Share of each daughter} = \frac{116140}{2} = 58320 \text{ rupees.}$$

Q.5: A woman died leaving behind property of Rs. 260880.

Rs. 6080 were spent on her burial. Remaining amount was distributed among her husband, father and two

daughters in the ratio $\frac{1}{4} : \frac{1}{6} : \frac{2}{3}$. Find the share of each

heir.

Solution: Total assets = 260880 rupees

Amount spent on burial = 6080 rupees

Remaining mount = 260880 – 6080

= 254800 rupees

husband father : daughter

$$\frac{1}{4} : \frac{1}{6} : \frac{2}{3}$$

$$\text{Sum of ratios} = \frac{1}{4} + \frac{1}{6} + \frac{2}{3}$$

$$= \frac{3+2+8}{12} = \frac{13}{12}$$

$$\text{Share of husband} = \frac{1/4}{13/12} \times 254800$$

$$= \frac{1}{4} \times \frac{12}{13} \times 254800$$

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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$$= \frac{3057600}{52} = 58800 \text{ rupees .}$$

$$\begin{aligned} \text{Share of father} &= \frac{1/6}{13/12} \times 254800 \\ &= \frac{1}{6} \times \frac{12}{13} \times 254800 \\ &= \frac{3057600}{78} = 39200 \text{ rupees .} \end{aligned}$$

$$\begin{aligned} \text{Share of daughters} &= \frac{2/3}{13/12} \times 254800 \\ &= \frac{2}{3} \times \frac{12}{13} \times 254800 \\ &= \frac{6115200}{39} \\ &= 156800 \text{ rupees .} \end{aligned}$$

$$\text{Share of each daughter} = \frac{156800}{2} = 78400 \text{ rupees .}$$

Q.6: A person died leaving behind a property worth Rs. 350,000 . He had no children .His property was Divided between his mother and widow in the ratio of $\frac{1}{3} : \frac{1}{4}$, after payment of Rs. 70,000 to his widow as mahr . Find the share of each .

Solution: Total assets = 350,000 rupees

Amount on mahr = 70,000 rupees

Remaining mount = 350,000 – 70000
 = 280000 rupees

widow mother

$$\frac{1}{3} : \frac{1}{4}$$

$$\text{Sum of ratios} = \frac{1}{3} + \frac{1}{4} = \frac{4+3}{12}$$

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$$= \frac{7}{12}$$

$$\text{Share of widow} = \frac{1/3}{7/12} \times 280000$$

$$= \frac{1}{3} \times \frac{12}{7} \times 280000$$

$$= \frac{3360000}{21}$$

$$= 160000 \text{ rupees .}$$

$$\text{Share of mother} = \frac{1/4}{7/12} \times 280000$$

$$= \frac{1}{4} \times \frac{12}{7} \times 280000$$

$$= \frac{3360000}{28}$$

$$= 120000 \text{ rupees .}$$

Exercise 2.4 (objective type Questions)

Q.1: Read the following statement carefully. Encircle "T" if the statement is true and "F" in case it is wrong .

- (i) Zakat becomes compulsory after one year of Nisab possession . T / F
- (ii) Nisab of silver for payment of Zakat is 87 gm T / F
- (iii) Rate of Zakat is 0.025 of the saving . T / F
- (iv) Ushr is a government tax levied on agricultural produce T / F
- (v) Ushr is paid after every harvest T / F
- (vi) where no manual labour is involved in irrigation rat of ushr is 10 % T / F
- (vii) where manual labour is involved in irrigation rat of ushr is 10 % T / F

Answers: (i) T (ii) F (iii) T (iv) F (v) T (vi) T (vii) F

Q.2: Four suggested answers are given for each question.

Select the correct answer and write the corresponding

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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letter (i.e. a , b , c , d) in the box given in front of the question .

(i) Nisab of gold for payment of Zakat is

- (a) 7.5 gm (b) 87 gm
(c) 52 gm (d) 609 gm

(ii) Nisab of silver for payment of Zakat is

- (a) 7.5 gm (b) 87 gm
(c) 52 gm (d) 609 gm

(iii) Rat of Zakat is of the saving

- (a) 2.5 % (b) $\frac{1}{40}$ th
(c) 0.025 (d) All of these

(iv) Zakat payable on Rs. 100,000 is

- (a) Rs. 2500 (b) Rs. 25000
(c) Rs. 4000 (d) Rs .40000

(v) Ushr is payable on

- (a) crop (b) Gold
(c) silver (d) all of these

(vii) Right of inheritance is established :

- (a) after the death of a person
(b) in accordance with the will .
(c) after payment of debts of deceased .
(d) after the burial process .

Answers: (i) b (ii) d (iii) a (iv) a (v) a
(vi) c (vii) d

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

UNIT - 3 :

Business Mathematics .

Cost price (C.P.); The Purchased price of an article is called Cost price (C . P .) .

Selling price (S.P.); The Sold price of an article is called Selling price (S . P .) .

Note: If S.P. is greater than C . P .

Then (i) Profit = S . P – C . P .

Or (ii) C . P = S . P – Profit

Or (iii) S . P = C . P . + profit

Profit percent : (i) Profit % = $\frac{\text{profit}}{C.P.} \times 100$

Profit in term C . P . and Profit percent :

$$\text{Profit} = \frac{C.P \times \text{Profit \%}}{100}$$

Note: If C.P. is greater than S . P .

Then (i) Loss = C . P – S . P .

Or (ii) C . P = S . P + Loss

Or (iii) S . P = C . P . – Loss

Loss percent : (i) Loss % = $\frac{\text{Loss}}{C.P.} \times 100$

Loss in term C . P . and Loss percent :

$$\text{Loss} = \frac{C.P \times \text{Loss \%}}{100}$$

Exercise 3.1:

Q.1: Find profit or loss when

(i) Cost price = Rs. 80 and selling price = Rs. 84

(ii) Cost price = Rs. 225.50 and selling price = Rs. 240

(iii) Cost price = Rs.250 and selling price = Rs. 239.75

Solution: (i) As S . P . is greater than C . P .

Then Profit = S . P – C . P(i) put values

$$\text{Profit} = 84 - 80 = \text{Rs. } 4$$

(ii) As S . P . is greater than C . P .

Then Profit = S . P – C . P(i) put values

$$\text{Profit} = 240 - 225.50 = \text{Rs. } 14.5$$

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

(i.) As C . P . is greater than S . P .

Then Loss = C .P – S . P(i) put values

$$\text{Loss} = 250 - 239.75 = \text{Rs. } 11.25$$

Q.2: Find the cost price when :

(i) Selling price = Rs. 73 and profit = Rs. 15

(ii) Selling price = Rs.112.25 and Loss = Rs. 9.75

(iii) Selling price = Rs.443.75 and Loss = Rs. 19.50

Solution: (i) As C . P . = S . P . – Profit

$$\Rightarrow \text{C . P .} = 73 - 15 = \text{Rs. } 58$$

(ii) C .P = S.P + Loss

$$\Rightarrow \text{C .P .} = 112.25 + 9.75 = \text{Rs. } 122$$

(iii) C .P = S.P + Loss

$$\Rightarrow \text{C .P .} = 443.75 + 19.50 = \text{Rs. } 463.25$$

Q.3: Find the selling price , when

(i) Cost price = Rs. 112 and profit = Rs. 7.50

(ii) Cost price = Rs.1116 and Loss = Rs. 44

(iii) Cost price = Rs.442.92 and profit = Rs. 1.05

Solution: (i) As S .P = C .P + profit

$$\Rightarrow \text{S.P .} = 112 + 7.50 = \text{Rs. } 119.50$$

(ii) S.P = C.P – Loss

$$\Rightarrow \text{S .P} = 1116 - 44 = \text{Rs. } 1072$$

(iii) As S .P = C .P + profit

$$\Rightarrow \text{S.P .} = 442.92 + 1.05 = \text{Rs. } 443.97$$

Q.4: Find profit or Loss percent , when

(i) Cost price = Rs. 760 and selling price = Rs. 855

(ii) Cost price = Rs. 14100 and selling price = Rs.14699.25

(iii) Cost price = Rs.15400 and selling price = Rs.15823.50

Solution: (i) As S . P . is greater than C . P .

Then Profit = S .P – C . P(i) put values

$$\text{Profit} = 855 - 760 = \text{Rs. } 95 .$$

$$\text{Now Profit \%} = \frac{\text{profit}}{\text{C.P.}} \times 100 \dots\dots(ii)$$

Put values in (ii)

$$\text{Profit \%} = \frac{95}{760} \times 100 = \frac{950}{76} = 12.5 \%$$

(ii) As S . P . is greater than C . P .

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Then Profit = S.P – C . P(i) put values

$$\text{Profit} = 14699.25 - 14100 = \text{Rs. } 599.25 .$$

Now Profit % = $\frac{\text{profit}}{\text{C.P.}} \times 100 \dots\dots(\text{ii})$

Put values in (ii)

$$\text{Profit \%} = \frac{599.25}{14100} \times 100 = 4.25 \%$$

(iii) As S . P. is greater than C . P .

Then Profit = S.P – C . P(i) put values

$$\text{Profit} = 15823.50 - 15400 = \text{Rs. } 423.50 .$$

Now Profit % = $\frac{\text{profit}}{\text{C.P.}} \times 100 \dots\dots(\text{ii})$

Put values in (ii)

$$\text{Profit \%} = \frac{423.5}{15400} \times 100 = 2.75 \%$$

Q.5: Find the profit , when

(i) Cost price = Rs.1200 and profit % = 5 %

(ii) Cost price = Rs. 625 and profit % = 4 %

(iii) Cost price = Rs.963 and profit % = $7\frac{1}{3} \%$

Solution: (i) As Profit = $\frac{\text{C.P} \times \text{Profit \%}}{100}$

Put values

$$\text{Profit} = \frac{1200 \times 5}{100} = 60 \text{ rupees .}$$

(ii) As Profit = $\frac{\text{C.P} \times \text{Profit \%}}{100}$

Put values

$$\text{Profit} = \frac{625 \times 4}{100} = 25 \text{ rupees .}$$

(iii) As Profit = $\frac{\text{C.P} \times \text{Profit \%}}{100}$

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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$$\text{Here profit \%} = 7\frac{1}{3} = \frac{22}{3}$$

Put values

$$\begin{aligned}\text{Profit} &= \frac{963 \times \frac{22}{3}}{100} = \frac{963 \times 22}{3 \times 100} = \frac{21186}{300} \\ &= 70.62 \text{ rupees.}\end{aligned}$$

Q.6: Find the loss, when

(i) Cost price = 900 and Loss % = 2 %

(ii) Cost price = 675 and Loss % = 5 %

(iii) Cost price = 2300 and Loss % = $6\frac{1}{4}$ %

Solution: (i)

$$\text{Loss} = \frac{C.P \times \text{Loss \%}}{100}, \text{ put values}$$

$$\Rightarrow \text{Loss} = \frac{900 \times 2}{100} = 18 \text{ rupees}$$

$$(ii) \text{ Loss} = \frac{C.P \times \text{Loss \%}}{100}, \text{ put values}$$

$$\Rightarrow \text{Loss} = \frac{675 \times 5}{100} = 33.75 \text{ rupees}$$

(iii) Here C.P = Rs. 2300

$$\begin{aligned}\text{Loss \%} &= 6\frac{1}{4} \% \\ &= \frac{25}{4} \%\end{aligned}$$

$$\text{Loss} = \frac{C.P \times \text{Loss \%}}{100}, \text{ put values}$$

$$\Rightarrow \text{Loss} = \frac{2300 \times \frac{25}{4}}{100} = \frac{575}{4} = 143.75 \text{ rupees}$$

Q.7: Nasir purchased a motorcycle for Rs. 75000 and sold it for Rs. 79500. Find his profit or loss percent.

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Solution: C.P = Rs.75000 and S.P = Rs 79500

Profit = S.P – C . P. Put values

$$\Rightarrow \text{Profit} = 79500 - 75000 = 4500 \text{ rupees}$$

$$\text{Now Profit \%} = \frac{\text{profit}}{\text{C.P.}} \times 100 \dots\dots(i)$$

Put values in (i)

$$\text{Profit \%} = \frac{4500}{75000} \times 100 = \frac{450}{75} = 6 \%$$

Q.8: Asma purchased an air ticket for Rs. 14250, but due to some emergency she had cancel the ticket. She was backed paid Rs. 12825 .Calculate the loss percent that she had loss .

Solution: Here C . P = RS. 14250 , S.P. = Rs. 12825

Loss = C.P – S.P Put values

$$\Rightarrow \text{Loss} = 14250 - 12825 = 1425 \text{ rupees .}$$

$$\text{As Loss \%} = \frac{\text{Loss}}{\text{C.P.}} \times 100 \text{ put values}$$

$$\Rightarrow \text{Loss \%} = \frac{1425}{14250} \times 100 = 10 \%$$

Q.9: A shopkeeper bought 850 oranges at the rate of Rs. 700 per 100 . 10 oranges were found rotten . He Sold the remaining oranges at the rate of Rs.102 per dozen . Find his profit or Loss percent .

Solution: Total orsnge = 850 .

As 100 oranges cost price = Rs.700

$$\begin{aligned} \text{Then 850 oranges cost price} &= \frac{700}{100} \times 850 \\ &= \text{Rs. 5950} \end{aligned}$$

Number of rotten oranges = 10

Remaining oranges = 850 – 10 = 840

As Selling price of 12 oranges = Rs 102

$$\begin{aligned} \text{Selling price of 840 oranges} &= \frac{102}{12} \times 840 \\ &= 7140 \text{ rupees} \end{aligned}$$

As S . P. is greater than C . P .

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Then Profit = S.P – C.P(i) put values

$$\Rightarrow \text{Profit} = 7140 - 5950 = 1190 \text{ rupees.}$$

Now Profit % = $\frac{\text{profit}}{\text{C.P.}} \times 100 \dots\dots(i)$

Put values in (i)

$$\text{Profit \%} = \frac{1190}{5950} \times 100 = 20 \%$$

Q.10: A shopkeeper bought 5 dozen shampoo bottles at the rate of Rs. 2400 per dozen and sold them for Rs. 210 each.

Find his profit or Loss percent.

Solution: Total shampoo = $5 \times 12 = 60$.

As 1 dozen cost price = Rs.2400

Total cost price = $5 \times 2400 = 12000$ rupees

As Selling price of 1 shampoo = Rs 210

$$\begin{aligned} \text{Selling price of 60 oranges} &= 210 \times 60 \\ &= 12600 \text{ rupees} \end{aligned}$$

As S.P. is greater than C.P.

Then Profit = S.P – C.P(i) put values

$$\Rightarrow \text{Profit} = 12600 - 12000 = 600 \text{ rupees.}$$

Now Profit % = $\frac{\text{profit}}{\text{C.P.}} \times 100 \dots\dots(i)$

Put values in (i)

$$\text{Profit \%} = \frac{600}{12000} \times 100 = 5 \%$$

C.P. in terms of S.P. and Profit percent :

$$\text{C.P} = \frac{100 \times \text{S.P.}}{100 + \text{Profit \%}}$$

C.P. in terms of S.P. and Loss percent :

$$\text{C.P} = \frac{100 \times \text{S.P.}}{100 - \text{Loss \%}}$$

S.P. in terms of C.P. and Profit percent :

$$\text{S.P} = \text{CP} \times \left(\frac{100 + \text{Profit \%}}{100} \right)$$

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S. P. in terms of C.P. and Loss percent :

$$S.P = CP \times \left(\frac{100 - \text{Loss \%}}{100} \right)$$

Exercise 3.2:

Q. 1: Find the selling price , when

(i) Cost price = Rs. 250 and profit % = 5 %

(ii) Cost price = Rs.8000 and profit % =4.5 %

(iii) Cost price = Rs. 12290 and profit % = 3.6 %

Solution: (i) As we know that

$$S.P = CP \times \left(\frac{100 + \text{Profit \%}}{100} \right) \dots\dots(i)$$

Put C.P = Rs. 250 and profit % = 5 % in (i)

$$\begin{aligned} \Rightarrow S.P &= 250 \times \left(\frac{100 + 5}{100} \right) = 250 \times \frac{105}{100} \\ &= \text{Rs. } 262.5 \end{aligned}$$

(ii) As we know that

$$S.P = CP \times \left(\frac{100 + \text{Profit \%}}{100} \right) \dots\dots(i)$$

Put C.P = Rs. 8000 and profit % = 4.5 % in (i)

$$\begin{aligned} \Rightarrow S.P &= 8000 \times \left(\frac{100 + 4.5}{100} \right) = 8000 \times \frac{104.5}{100} \\ &= \text{Rs. } 8360 \end{aligned}$$

(iii, As we know that

$$S.P = CP \times \left(\frac{100 + \text{Profit \%}}{100} \right) \dots\dots(i)$$

Put C.P = Rs. 12290 and profit % = 3.6 % in (i)

$$\begin{aligned} \Rightarrow S.P &= 12290 \times \left(\frac{100 + 3.6}{100} \right) = 12290 \times \frac{103.6}{100} \\ &= \text{Rs. } 12732.44 \end{aligned}$$

Q. 2 Find the Cost price , when

(i) Selling price = Rs.12100 and profit % = 10 %

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(ii) Selling price = Rs. 38456 and profit % = 4.5 %

(iii) Selling price = Rs.46476.60 and profit % = 9.6 %

Solution: (i) As we know that

$$C.P = \frac{100 \times S.P.}{100 + Profit \%} \dots\dots(i)$$

Put S.P = 12100 and profit % = 10 in (i)

$$\Rightarrow C.P = \frac{100 \times 12100}{100 + 10} = \frac{1210000}{110}$$

$$= Rs.11000$$

(ii) As we know that

$$C.P = \frac{100 \times S.P.}{100 + Profit \%} \dots\dots(i)$$

Put S.P = 38456 and profit % = 4.5 in (i)

$$\Rightarrow C.P = \frac{100 \times 38456}{100 + 4.5} = \frac{3845600}{104.5}$$

$$= Rs.36800$$

(iii) As we know that

$$C.P = \frac{100 \times S.P.}{100 + Profit \%} \dots\dots(i)$$

Put S.P = 46474.60 and profit % = 9.1 in (i)

$$\Rightarrow C.P = \frac{100 \times 46474.60}{100 + 9.1} = \frac{4647460}{109.1}$$

$$= Rs.42598.167$$

Q.3: Sajid had Rs. 60500 in his bank account . He was given a profit of 4.5 % on his investment. How much is the total amount in his account .

Solution; Amount in account = Rs. 60500

Profit = 4.5 %

$$\text{Total amount in account} = \text{amount} \times \left(\frac{100 + Profit \%}{100} \right)$$

Put values

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$$\begin{aligned}\Rightarrow \text{Total amount in account} &= 60500 \times \left(\frac{100 + 4.5}{100} \right) \\ &= 605 \times 104.5 \\ &= \text{Rs. } 63222.5\end{aligned}$$

Q.4; Mehmood bought a house for Rs. 8 million and sold it at a profit of 5.75 %. What is the selling price of the house ? .

Solution: Cost price = 8 million = 8×1000000
 = 8000000 rupees .

$$\text{profit \%} = 5.75 \%$$

As we know that

$$S.P = C.P \times \left(\frac{100 + \text{Profit \%}}{100} \right) \dots\dots(i)$$

Put C.P = Rs. 8000000 and profit % = 5.75 % in (i)

$$\begin{aligned}\Rightarrow S.P &= 8000000 \times \left(\frac{100 + 5.75}{100} \right) = 80000 \times 105.75 \\ &= \text{Rs. } 8460000\end{aligned}$$

Selling price = Rs. 8460000 or 8.46 million .

Q.5: Naeem purchased a computer for Rs. 31,250 and sold it at a loss of 20 % .Find the selling price of the computer .

Solution: Cost price = Rs. 31,250
 Loss % = 20 %

As we know that

$$S.P = C.P \times \left(\frac{100 - \text{Loss \%}}{100} \right) \quad \text{put values}$$

$$\begin{aligned}\Rightarrow S.P &= 31250 \times \left(\frac{100 - 20}{100} \right) = 3125 \times \frac{80}{10} \\ &= \text{Rs. } 25000\end{aligned}$$

Thus selling price = Rs. 25000 .

Q.6: A shopkeeper bought 100 kg of tomatoes for Rs. 2500 . He sold the tomatoes by suffering 3 % loss . At what rate per kilogram did he sell the

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tomatoes .

Solution: Cost price of 100 kg tomatoes = Rs.2500

$$\text{Cost price of 1 kg tomatoes} = \frac{2500}{100} = \text{Rs.}25$$

$$\text{Loss \%} = 3 \%$$

As we know that

$$S.P = CP \times \left(\frac{100 - \text{Loss \%}}{100} \right) \quad \text{put values}$$

$$\Rightarrow S.P. = 25 \times \left(\frac{100 - 3}{100} \right) = 25 \times \frac{97}{100} \\ = \text{Rs.}24.25$$

He sold 1 kg kilogram tomato = Rs. 24.25

Q.7: Hafsa sold her car at 3.75 % profit . If she bought the car for Rs. 176,640 , what was the selling price of the car ?

Solution: Cost price = Rs. 176,640

$$\text{profit \%} = 3.75 \%$$

As we know that

$$S.P = CP \times \left(\frac{100 + \text{Profit \%}}{100} \right) \quad \dots\dots(i)$$

$$\Rightarrow S.P = 176640 \times \left(\frac{100 + 3.75}{100} \right) = 17664 \times \frac{103.75}{10} \\ = \text{Rs.}183264$$

Selling price = Rs. 183264 .

Q.8: Amjad purchased furniture for Rs. 132000 and sold it at a loss of 8.5 % . Find the selling price of furniture .

Solution: Cost price = Rs. 132000

$$\text{Loss \%} = 8.5 \%$$

As we know that

$$S.P = CP \times \left(\frac{100 - \text{Loss \%}}{100} \right) \quad \text{put values}$$

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$$\Rightarrow S.P. = 132000 \times \left(\frac{100 - 8.5}{100} \right) = 1320 \times 91.5$$
$$= Rs. 120780$$

Thus selling price = Rs. 120780 .

Q.9: Tariq bought a piece of land for Rs. 240,000 and sold it at a profit of 11.25 % . Find the selling price of the plot .

Solution: Cost price = Rs. 240,000
profit % = 11.25 %

As we know that

$$S.P = CP \times \left(\frac{100 + Profit \%}{100} \right) \dots\dots(i)$$

$$\Rightarrow S.P = 240000 \times \left(\frac{100 + 11.25}{100} \right) = 2400 \times 111.25$$
$$= Rs. 267000$$

Selling price = Rs. 267000 .

Q.10 : A pick up was purchased for Rs. 325,000 and was sold at a loss of 13 % . Find the selling price of the pick up .

Solution: Cost price = Rs. 325000
Loss % = 13 %

As we know that

$$S.P = CP \times \left(\frac{100 - Loss \%}{100} \right) \text{ put values}$$

$$\Rightarrow S.P. = 325000 \times \left(\frac{100 - 13}{100} \right) = 3250 \times 87$$
$$= Rs. 282750$$

Thus selling price = Rs. 282750 .

Q.11: A group of companies sold an hotel at Rs. 992 Million and earned a profit of 24 % .What Was the cost price of the pick up ? .

Solution: Selling price = Rs. 992 million
= Rs. 992 × 1000000

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$$= \text{Rs } 992000000$$

As we know that

$$C.P = \frac{100 \times S.P.}{100 + \text{Profit \%}} \dots\dots(i)$$

Put $S.P = 992000000$ and profit $\% = 24$ in (i)

$$\Rightarrow C.P = \frac{100 \times 992000000}{100 + 24} = \frac{99200000000}{124}$$

$$= \text{Rs. } 800000000$$

Thus cost price = Rs. 800,000,000
 = Rs. 800 million

Q.12: A watch was sold at Rs. 582 by suffering a loss of 3 %. Find its cost price ?

Solution: As $S.P = \text{Rs. } 582$
 Loss $\% = 3 \%$

As we know that

$$C.P = \frac{100 \times S.P.}{100 - \text{Loss \%}} \quad \text{put values}$$

$$\Rightarrow C.P. = \frac{100 \times 582}{100 - 3} = \frac{58200}{97}$$

$$\rightarrow C.P = \text{Rs } 600$$

Q.13: A dealer sold 15 bags of cement for Rs. 4275 and earned a profit of 14 %. What was the cost price of cement per bag ?

Solution : Sold price of 15 bags of cement = Rs. 4275
 profit $\% = 14 \%$.

As we know that

$$C.P = \frac{100 \times S.P.}{100 + \text{Profit \%}} \dots\dots(i)$$

Put values

$$\Rightarrow C.P. = \frac{100 \times 4275}{100 + 14} = \frac{427500}{114}$$

$$= \text{Rs. } 3750$$

Thus 15 bags of cement cost price = Rs. 3750

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$$1 \text{ bag of cement cost price} = \frac{3750}{15} = \text{Rs. } 250$$

Q.14: A trader sold 5 TV sets for Rs.59500 and earned a profit of 12 %. Find the cost price of one TV.

Solution: Sold price of 5 TV of cement = Rs. 59500
 profit % = 12 % .

As we know that

$$C.P = \frac{100 \times S.P.}{100 + \text{Profit \%}} \dots\dots(i)$$

Put values

$$\Rightarrow C.P. = \frac{100 \times 59500}{100 + 12} = \frac{5950000}{112}$$

$$= \text{Rs. } 53125$$

Thus 5 TV cost price = Rs. 53125

$$1 \text{ TV cost price} = \frac{53125}{5} = \text{Rs. } 10625$$

Discount: Regular price or original price is called Market price (M . P .) , Then the amount which reduced the market value is called Discount .

$$\text{Discount} = M . P . - S . P . \dots(i)$$

$$\text{Discount \%} = \frac{\text{Discount}}{M.P.} \times 100 \dots\dots(ii)$$

Now Discount in term of Discount % is

$$\text{Discount} = MP \times \frac{\text{Discount \%}}{100}$$

Exercise 3.3:

Q.1: Find the discount when :

(i) Market price = Rs. 220 , Selling price = Rs. 198

(ii) Market price = Rs. 495 , Selling price = Rs. 473.25

Solution: (i) Here M.P = Rs.220 and S.P = 198

As Discount = M . P – S . P , put values

$$\Rightarrow \text{Discount} = 220 - 198 = \text{Rs. } 22$$

(ii) Here M.P = Rs.495 and S.P = Rs. 473.25

As Discount = M . P – S . P , put values

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$$\Rightarrow \text{Discount} = 495 - 473.25 = \text{Rs. } 21.75$$

Q.2: Find the Selling when :

(i) Market price = Rs.285 , Discount = Rs.23

(ii) Market price = Rs.580 , Discount = Rs.35.50

Solution: (i) Here M.P = Rs.285 , Discount = Rs.23

Then S.P. = M.P - Discount , put values

$$\Rightarrow \text{S.P} = 285 - 23 = \text{Rs. } 262$$

(ii) Here M.P = Rs.580 , Discount = Rs.35.5

Then S.P. = M.P - Discount , put values

$$\Rightarrow \text{S.P} = 580 - 35.5 = \text{Rs. } 544.5$$

Q.3: Find the discount percent when :

(i) Market price = Rs.89 , Discount = Rs.22.25

(ii) Market price = Rs.950 , Discount = Rs.47.50 ,

Solution:(i) Here M.P. = RS. 89 . Discount = Rs.22.25

$$\text{Discount \%} = \frac{\text{Discount}}{\text{M.P.}} \times 100 \dots\dots(i) \text{ put values}$$

$$\begin{aligned} \Rightarrow \text{Discount \%} &= \frac{22.25}{89} \times 100 \\ &= 25.28 \% . \end{aligned}$$

(ii) Here M.P. = RS. 950 . Discount = Rs.47.50

$$\text{Discount \%} = \frac{\text{Discount}}{\text{M.P.}} \times 100 \dots\dots(i) \text{ put values}$$

$$\begin{aligned} \Rightarrow \text{Discount \%} &= \frac{47.50}{950} \times 100 \\ &= 5 \% \end{aligned}$$

Q.4: Find the Selling when :

(i) Market price = Rs.2200 , Discount % = 2.5%

(ii) Market price = Rs.3650 , Discount% = 10%

Solution:(i) Here M.P =Rs.2200 , Discount % = Rs.2.5

$$\text{Selling price} = \text{MP} \times \frac{100 - \text{Discount\%}}{100} \dots\dots(i)$$

Put values (i)

$$\Rightarrow \text{Selling price} = 2200 \times \frac{100 - 2.5}{100}$$

$$\Rightarrow \text{S.P} = 22 \times 97.5 = \text{Rs. } 2145$$

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(ii) Here $M.P = \text{Rs. } 3650$, Discount % = 10%

$$\text{Selling price} = M.P \times \frac{100 - \text{Discount \%}}{100} \dots (i)$$

Put values (i)

$$\Rightarrow \text{Selling price} = 3650 \times \frac{100 - 10}{100}$$

$$\Rightarrow S.P = 365 \times 9 = \text{Rs. } 3285$$

Q.5: Find the market price when :

(i) Selling price = Rs. 9000, Discount % = 10 %

(ii) Selling price = Rs. 18600, Discount % = 16 %

(iii) Selling price = Rs. 55500, Discount % = 7.5 %

Solution: (i) Here $S.P = \text{Rs. } 9000$, Discount % = 10 %

$$\text{As Market price} = S.P \times \frac{100}{100 - \text{Discount \%}} \dots (i)$$

Put values

$$\Rightarrow M.P = 9000 \times \frac{100}{100 - 10} = 9000 \times \frac{100}{90}$$

$$\Rightarrow M.P = 100 \times 100 = \text{Rs. } 10000$$

(ii) Here $S.P = \text{Rs. } 18600$, Discount % = 16 %

$$\text{As market price} = S.P \times \frac{100}{100 - \text{Discount \%}} \dots (i)$$

Put values

$$\Rightarrow M.P = 18600 \times \frac{100}{100 - 16} = 18600 \times \frac{100}{84}$$

$$\Rightarrow M.P = \text{Rs. } 22142.86$$

(iii) Here $S.P = \text{Rs. } 55000$, Discount % = 7.5 %

$$\text{As market price} = S.P \times \frac{100}{100 - \text{Discount \%}} \dots (i)$$

Put values

$$\Rightarrow M.P = 55000 \times \frac{100}{100 - 7.5} = 55000 \times \frac{100}{92.5}$$

$$\Rightarrow M.P = \text{Rs. } 59459.459$$

Q.6: A discount of 20 % was given on a pair of athletic

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Shoes having marked price of Rs. 900 . Find discount .

Solution: Discount % = 20 % , M.P = Rs. 900

$$\text{Discount} = MP \times \frac{\text{Discount \%}}{100} \dots(i)$$

Put values in (i)

$$\text{Discount} = 900 \times \frac{20}{100} = \text{Rs.}180$$

Q.7: A discount of Rs. 22.25 was given on marked price of Rs. 178 . Find the discount price .

Solution: Discount = Rs. 22.25 , M.P = Rs. 178

$$\text{Discount \%} = \frac{\text{Discount}}{M.P.} \times 100 \dots\dots(i) \text{ put values}$$

$$\begin{aligned} \Rightarrow \text{Discount \%} &= \frac{22.25}{178} \times 100 \\ &= 12.5 \% . \end{aligned}$$

Q.8: During Eid sale , a bed set was discounted 25 % to Rs. 960 . Find its marked price .

Solution: S.P = Rs. 960 , Discount % = 25 %

$$\text{As Market price} = S.P. \times \frac{100}{100 - \text{Discount \%}} \dots\dots(i)$$

Put values

$$\Rightarrow M.P = 960 \times \frac{100}{100 - 25} = 960 \times \frac{100}{75}$$

$$\Rightarrow M.P = \text{Rs.} 1280$$

Q.9: During winter sale , 12 % discount was announced by a supper store .Uzma selected 2 blankets and 1 quilt for purchase whose marked price were Rs. 1750 per blanket and Rs. 1600 respectively .How much did he pay ? .

Solution: Discount % = 12 % ,

Marked price of 1 blanket = Rs. 1750

Marked price of 2 blankets = $2 \times 1750 = \text{Rs.}3500$

Marked price of 1 quilt = Rs.1600

Then total Market price = $3500 + 1600$

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=> M.P = Rs. 5100 , Now we find S.P.

$$\text{Selling price} = MP \times \frac{100 - \text{Discount}\%}{100} \dots(i)$$

Put values (i)

$$\Rightarrow \text{Selling price} = 5100 \times \frac{100 - 12}{100}$$

$$\Rightarrow S.P = 51 \times 88 = \text{Rs.} 4488,$$

Thus Uzma paid Rs. 4488 .

Q.10: A housing scheme announced a discount of 10 % on advance payment in full. Amjad intends to purchase a one kanal plot whose marked price is Rs. 4999 per marla .How much will he pay if he makes full payment in advanced ? Also find the total discount .

Solution: Market price of 1 marla = Rs. 4999

Since 1 kanal = 20 marla .

$$\text{Total market price} = 20 \times 4999 = \text{Rs.} 99980$$

Discount % = 10 % .

S.P. = ? and Discount = ?

$$\text{As } \text{Selling price} = MP \times \frac{100 - \text{Discount}\%}{100} \dots(i)$$

Put values (i)

$$\Rightarrow \text{Selling price} = 99980 \times \frac{100 - 10}{100}$$

$$\Rightarrow S.P = 9998 \times 9 = \text{Rs.} 89982,$$

Thus Amjad paid Rs. 89982 .

Now total discount :

$$\text{Discount} = MP \times \frac{\text{Discount}\%}{100} \dots(i)$$

Put values in (i)

$$\text{Discount} = 99980 \times \frac{10}{100} = \text{Rs.} 9998$$

• **Q.11:** A corolla car was discounted 5 % to Rs. 123750 .

Find its market price . Also find total discount .

Solution: Selling price = S .P. = Rs. 123750

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Discounted % = 5 %

M.P. = ? , Discount = ?

As Market price = $S.P. \times \frac{100}{100 - \text{Discount \%}}$ (i)

Put values

$$\Rightarrow M.P = 1239750 \times \frac{100}{100 - 5} = \frac{123975000}{95}$$

$$\Rightarrow M.P = \text{Rs. } 1305000$$

Now total discount :

$$\text{Discount} = MP \times \frac{\text{Discount \%}}{100} \text{(i)}$$

Put values in (i)

$$\text{Discount} = 1305000 \times \frac{5}{100} = \text{Rs. } 65250$$

Exercise.3.4:

Q.1: Ainee and maryam started a business with the investment of Rs. 8000 and Rs. 6000 respectively . At the end of the year , they earned a profit of Rs. 2800.

Find the share of each in profit .

Solution: Total profit = Rs. 2800

Ainee	:	Maryam	
8000	:	600	
4	:	3	divided by 200

Sum of ratios = 3 + 4 = 7

$$\text{Profit of Ainee} = \frac{4}{7} \times 2800 = 4 \times 400 = \text{Rs. } 1600$$

$$\text{Profit of maryam} = \frac{3}{7} \times 2800 = 3 \times 400 = \text{Rs. } 1200$$

Q.2: Najam , Niaz and Nadeem entered into a joint Business by investing Rs. 100,000 ,Rs. 87500 and Rs. 65000 respectively . After 6 months they earned a profit of Rs. 3939 . Find the share of each in profit .

Solution: Total profit = Rs. 3939

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$$\begin{array}{rcl}
 \text{Najam} & : & \text{Niaz} & : & \text{Nadeem} \\
 100000 & : & 87500 & : & 65000 \\
 1000 & : & 875 & : & 650 \quad \text{divided by } 100 \\
 200 & : & 175 & : & 130 \quad \text{divided by } 5 \\
 40 & : & 35 & ; & 26 \quad \text{divided by } 5
 \end{array}$$

$$\text{Sum of ratios} = 40 + 35 + 26 = 101$$

$$\text{Profit of Najam} = \frac{40}{101} \times 3939 = \text{Rs. } 1560$$

$$\text{Profit of Niaz} = \frac{35}{101} \times 3939 = \text{Rs. } 1365$$

$$\text{Profit of Nadeem} = \frac{26}{101} \times 3939 = \text{Rs. } 1014$$

Q.3: Naila and Hina ran a school Tuck shop by investing in the ratio of 4 : 7. One maid servant was engaged on part time basis for Rs. 900 per month. After 9 months they earned a profit of Rs. 30628. How much did they earn from the business individually ?.

Solution : Total profit = Rs. 30628

Salary of servant per month = Rs. 900

Salary of 9 months = $900 \times 9 = \text{Rs. } 8100$

Remaining profit = $30628 - 8100 = \text{Rs. } 22528$

Share of investment = 4 : 7

Then Share of profit = 4 : 7

Sum of ratio = $4 + 7 = 11$

$$\text{Share of Naila} = \frac{4}{11} \times 22528 = \text{Rs. } 8192$$

$$\text{Share of Hina} = \frac{7}{11} \times 22528 = \text{Rs. } 14336$$

Q.4: Musharaf, Sikandar and Jehangir started a business with a joint capital of Rs. 790,000 and earned a profit of 21296 rupees. If musharaf had invested Rs. 40000 more than sikandar and sikandar had invested Rs. 30000 more than jehangir, find the share of each in the profit ?.

Solution: Total investment = Rs. 790,000.

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Suppose share of jehangir = x

Then share of sikandar = $x + 30000$

Share of musharaf = $x + 30000 + 40000$
 $= x + 70000$

Then according to the conditions

$$x + x + 30000 + x + 70000 = 790000$$

$$\Rightarrow 3x + 100000 = 790000$$

$$\Rightarrow 3x = 790000 - 100000$$

$$\Rightarrow 3x = 690000$$

$$\Rightarrow x = \frac{690000}{3} = 230000$$

Share of jehangir = 230000 rupees .

share of sikandar = $230000 + 30000$
 $= 260000$ rupees .

Share of musharaf = $230000 + 70000$.
 $= 300000$ rupees .

Musharaf : Sikandar : Jehangir

300000	260000	230000	divided by 10000
30	26	23	

Total profit = Rs. 21296

Sum of ratios = $30 + 26 + 23 = 79$

$$\text{Profit of Musharaf} = \frac{30}{79} \times 21296 = \text{Rs. } 8087.08$$

$$\text{Profit of Sikandar} = \frac{26}{79} \times 21296 = \text{Rs. } 7008.81$$

$$\text{Profit of jehangir} = \frac{23}{79} \times 21296 = \text{Rs. } 6200.1$$

Q.5: Shahzad , Rafiq and Danish started a business with a joint capital of Rs. 25000 and suffered a loss of Rs. 375 . If shahzad had invested Rs. 200 more than Rafiq and Rs. 300 more than Danish. How much each would suffer the loss ? .

Solution: Total investment = Rs. 25000 .

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Suppose share of shahzad = x

Then share of Rafiq = $x - 200$

Share of Danish = $x - 300$

Then according to the conditions

$$x + x - 200 + x - 300 = 25000$$

$$\Rightarrow 3x - 500 = 25000$$

$$\Rightarrow 3x = 25000 + 500$$

$$\Rightarrow 3x = 25500$$

$$\Rightarrow x = \frac{25500}{3} = 8500$$

Share of Shahzad = 8500 rupees .

share of Rafiq = $8500 - 200$

= 8300 rupees .

Share of Danish = $8500 - 300$.

= 8200 rupees .

Shahzad : Rafiq : Danish

8500	8300	8200	divided by 100
85	83	82	

Sum of ratios = $85 + 83 + 82 = 250$

$$\text{Loss of Shahzad} = \frac{85}{250} \times 375 = \text{Rs.} 127.5$$

$$\text{Loss of Rafiq} = \frac{83}{250} \times 375 = \text{Rs.} 124.5$$

$$\text{Loss of Danish} = \frac{82}{250} \times 375 = \text{Rs.} 123$$

Q.6: Razia , Zohra , Yasmeen and Riffat invested in the ratio of $5 : 3 : 2 : 4$ in a Meena Bazaar earned a profit of Rs. 4480 . They donated Rs. 1500 to Red Crescent Society and Rs. 2000 to a cancer hospital .

How much profit they gain individually ? .

Solution: Total profit = Rs. 4480

Donated to Red Crescent Society = Rs. 1500

Donated cancer hospital = Rs. 2000

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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$$\begin{aligned}\text{Remaining profit} &= 4480 - (1500 + 2000) \\ &= 4480 - 3500 \\ &= \text{Rs. } 980\end{aligned}$$

$$\text{Sum of ratio} = 5 + 3 + 2 + 4 = 14$$

$$\text{Profit of Razia} = \frac{5}{14} \times 980 = \text{Rs. } 350$$

$$\text{Profit of Zohara} = \frac{3}{14} \times 980 = \text{Rs. } 210$$

$$\text{Profit of Yasmeen} = \frac{2}{14} \times 980 = \text{Rs. } 140$$

$$\text{Profit of Riffat} = \frac{4}{14} \times 980 = \text{Rs. } 280$$

Q.7: Kamran , Kaukab and Kazim jointly started a business .Kamran invested Rs. 30,000 for one year , kaukab Rs. 36000 for 8 months and Kazim Rs. 72,000 for 3 months . How would they share a profit of Rs. 9300 ?

Solution: Total profit = Rs. 9300

For 12 months kamran invested = Rs. 30000

For 8 months kaukab invested = Rs. 36000

For 3 months kazim invested = Rs. 72000

Kamran : Kaukab : Kazim

$$30000 \times 12 : 36000 \times 8 : 72000 \times 3$$

$$360000 : 288000 : 216000 \quad \text{divided by } 1000$$

$$360 : 288 : 216 \quad \text{divided by } 12$$

$$30 : 24 : 18 \quad \text{divided by } 6$$

$$5 : 4 : 3$$

$$\text{Sum of ratios} = 5 + 4 + 3 = 12$$

$$\text{Profit of kamran} = \frac{5}{12} \times 9300 = \text{Rs. } 3875$$

$$\text{Profit of kaukab} = \frac{4}{12} \times 9300 = \text{Rs. } 3100$$

$$\text{Profit of kaukab} = \frac{3}{12} \times 9300 = \text{Rs. } 2325$$

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Exercise 3.5 (Objective Type Questions):

Q.1: Read the following statement carefully. Encircle "T"

if the statement is true and "F" in case it is wrong .

- (i) Cost price of Rs. 375 and selling price of Rs. 285 gives a profit of Rs. 90 . T / F
- (ii) selling price of Rs. 660 and Cost price of Rs. 575 gives a profit of Rs. 85 . T / F
- (iii) Cost price of Rs. 500 and selling price of Rs. 425 gives a profit of 15 % . T / F
- (iv) Cost price of Rs. 425 and selling price of Rs. 459 gives a profit of 34 % . T / F
- (v) If Cost price of Rs. 520 and profit is 5 % , then Selling price is Rs. 546 . T / F
- (vi) If selling price is Rs. 873 and loss 3 % then Cost price is Rs. 800 . T / F
- (vii) If marked price is Rs. 950 and selling price is Rs. 915 then discount is 35 % .
- (ix) Two business partners invested in the ratio of 3 : 5 . Profit will be distributed between them in the ratio of 5 : 3 .
- (x) Investors , investing Rs. 5 million and Rs. 5.5 Million will earn profit in the ratio of 10 : 11 .

Answers: (i) F (ii) T (iii) T (iv) F (v) T (vi) F (vii) T (viii) F (ix) F (x) T

Q.2: Four suggested answers are given for each question. Select the correct answer and write the corresponding letter (i.e. a , b , c , d) in the box given in front of the question .

- (i) Cost price of Rs.320 and selling price of Rs. 365 , Profit is (a) Rs. 45 (b) Rs.55 (c) Rs. 145 (d) Rs.35
- (ii) Cost price of Rs.517 and selling price of Rs. 490 , * Loss is (a) Rs. 73 (b) Rs.27 (c) Rs. 127 (d) Rs.17
- (iii) Cost price of Rs.550 and selling price of Rs. 594 , Profit % is (a) Rs. 44 % (b) Rs. 24 %

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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- (c) Rs. 8 % (d) Rs. 2 %
- (iv) Cost price of Rs. 675 and selling price of Rs. 621 ,
Loss % is (a) Rs. 54 % (b) Rs. 2 %
(c) Rs. 4 % (d) Rs. 8 %
- (v) Marked price is Rs. 330 , selling price is Rs. 297.
Discount % is : (a) Rs. 33 % (b) Rs. 10 %
(c) Rs. 5 % (d) Rs. 20 %
- (vi) selling price of Rs. 76 , marked price is :
(a) Rs. 95 (b) Rs. 120 (c) Rs. 96 (d) Rs. 100
- (vii) Selling price is Rs. 207 , profit is 3.5 % . Cost
Price is (a) Rs. 203.50 (b) Rs. 214
(c) Rs. 200 (d) Rs. 210.50
- (viii) Cost price Rs. 390 , Loss is 2.5 % . Selling price is:
(a) Rs. 387.50 (b) Rs. 380.25
(c) Rs. 382.50 (d) Rs. 381.25
- (ix) Ratio between the share in a profit of A and B is
4 : 5 . If A invested Rs. 32 million , what did B
invest ? (a) Rs. 2.56 million (b) Rs. 3.5 million
(c) Rs. 3.6 million (d) Rs. 40 million
- (x) A and B invested Rs. 25 lac and Rs. 30 lac
respectively . If A got a profit of Rs. 90,000 .
what was the total profit ?
(a) Rs. 180 ,000 (b) Rs. 172 ,000
(c) Rs. 198 ,000 (d) Rs. 298 ,000

Answers: (i) a (ii) b (iii) c (iv) d (v) b
(vi) a (vii) b (viii) b (ix) d (x) c

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

UNIT - 4 :

Financial Mathematics .

Calculation of profit and Mark up :

$$\text{Profit for one month} = \frac{\text{principal amount} \times \text{Rate of profit}}{100 \times 12}$$

$$\text{Loss for one month} = \frac{\text{principal amount} \times \text{Rate of loss}}{100 \times 12}$$

$$\text{Mark up} = \frac{\text{products} \times \text{Rate of Mark up}}{100 \times 365}$$

$$\text{Products} = \text{Number of days} \times \text{amount}$$

Calculation of principal amount :

$$\text{Principal amount} = \frac{100 \times 12 \times \text{profit}}{100 \times 12}$$

$$\text{Profit for one year} = \text{Principal amount} \times \text{Rate}$$

$$\text{Or Principal amount} = \frac{\text{profit}}{\text{Rate}}$$

Calculation of period : let "t" denote time(period) "r" denote rate "m" denote principal amount and "p" denote profit, then

$$P = r \times m \times t$$

$$\text{Or } t = \frac{P}{r \times m}$$

Exercise 4.1:

Q.1: Mr Akram deposits Rs. 50,000 in a PLS account .

If the profit rate is 10 % , then how much profit he would get after two months .

Ans: Principal amount = Rs. 50,000

Profit rate = 10 % . Then

$$\text{Profit for one month} = \frac{\text{principal amount} \times \text{Rate of profit}}{100 \times 12}$$

Put values

$$\text{Profit for one month} = \frac{50000 \times 10}{100 \times 12} = \frac{5000}{12}$$

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Profit for one month = Rs. 416.6

Profit for 2 months = $416.67 \times 2 = \text{Rs. } 833.33$

Q.2: Saima deposits Rs. 100000 in a PLS account . She got 10 % profit in one month and 12 % loss in the alternate month . Compute the original amount (principal) after two months .

Solution: Principal amount = Rs. 100,000

Profit rate = 10 % . Then

Profit for one month = $\frac{\text{principal amount} \times \text{Rate of profit}}{100 \times 12}$

Put values

Profit for one month = $\frac{100000 \times 10}{100 \times 12} = \frac{10000}{12}$

Profit for one month = 833.33

Present principal amount = $100000 + 833.33$
= Rs. 100833.33

Now loss in second month = 12 %

Profit for 2 months = $416.67 \times 2 = \text{Rs. } 833.33$

As we know that

Loss for one month = $\frac{\text{principal amount} \times \text{Rate of loss}}{100 \times 12}$

Put values

Loss for one month = $\frac{100833.33 \times 12}{100 \times 12}$
= Rs. 1008.33

Principal amount after two months = principal amount
- loss
= $100833.33 - 1008.33$
= Rs. 99825

Q. 3: A person opened a current account for deposit of his monthly salary (Rs. 20 ,000) . If the service charge is 2 % deducted from the salary . Then calculate the net salary for each month .

Ans. monthly salary = Rs. 20 ,000

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Service charge = 2 %

$$\begin{aligned}\text{Monthly Service charge} &= 200000 \times 2 \% \\ &= 20000 \times \frac{2}{100} = 200 \times 2 \\ &= \text{Rs. } 400\end{aligned}$$

$$\begin{aligned}\text{Net salary} &= \text{Salary} - \text{Service charge} \\ &= 20000 - 400 = \text{Rs. } 19600.\end{aligned}$$

Q.4: Salman deposit Rs. 50,000 for a period of 6 months in PLS term deposit account (TDR). If the profit rate for first 3 months is 12 % and 10 % for the remaining 3 months. Calculate the total profit for the 6 months.

Ans: Principal amount = Rs. 50,000

Profit rate for 3 months = 12 %. Then

$$\text{Profit for one month} = \frac{\text{principal amount} \times \text{Rate of profit}}{100 \times 12}$$

Put values

$$\text{Profit for one month} = \frac{50000 \times 12}{100 \times 12} = 500$$

$$\text{Profit for one month} = \text{Rs. } 500$$

$$\text{Profit for 3 months} = 500 \times 3 = \text{Rs. } 1500$$

Profit rate for next 3 months = 10 %. Then

$$\text{Profit for one month} = \frac{\text{principal amount} \times \text{Rate of profit}}{100 \times 12}$$

Put values

$$\text{Profit for one month} = \frac{50000 \times 10}{100 \times 12} = \frac{5000}{12}$$

$$\text{Profit for one month} = \text{Rs. } 416.6$$

$$\text{Profit for 3 months} = 416.67 \times 3 = \text{Rs. } 1250$$

$$\text{Total profit} = 1500 + 1200 = \text{Rs. } 2700$$

Q. 5: Jamil opened a foreign currency account in US dollars. If he has a total sum of 550 \$, then compute the profit per month at the rate of 10 % and convert the profit in PKRs.

(Hint : 1 US \$ = Rs. 80 approx)

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Ans: Jamil has in account = 500 dollars.

Profit rate = 10 %. Then

$$\text{Profit for one month} = \frac{\text{principal amount} \times \text{Rate of profit}}{100 \times 12}$$

Put values

$$\text{Profit for one month} = \frac{500 \times 10}{100 \times 12} = \frac{50}{12}$$

$$\text{Profit for one month} = 4.16 \text{ dollars}$$

As 1 US dollar = 80 rupees

$$4.16 \text{ US dollar} = 80 \times 4.16 = 333.33 \text{ rupees.}$$

Q.6: Convert the following currencies in PKRs.

(i) US \$ 100 (ii) 200 UK Pounds

(iii) 100 Qater Riyals (iv) 500 yen

Ans: (i) 1 US dollar = 80 rupees

$$100 \text{ US dollar} = 80 \times 100 = 8000 \text{ rupees.}$$

(ii) As 1 UK Pound = 132 rupees

$$200 \text{ UK Pound} = 200 \times 132 = 26400 \text{ rupees.}$$

(iii) As 1 Qater Riyal = 22 rupees

$$100 \text{ Qater Riyals} = 22 \times 100 = 2200 \text{ rupees.}$$

(iv) As 1 Yen = 0.88 rupees.

$$500 \text{ Yen} = 500 \times 0.88 = 440 \text{ rupees.}$$

Q.7: The price of T.V set in US dollars is 90 \$. If the Custom duty paid is 10 % . Calculate the price in PKRs.

Ans: T.V. price = 90 \$

$$1 \text{ US dollar} = 80 \text{ rupees}$$

$$90 \text{ US dollar} = 80 \times 90 = 7200 \text{ rupees.}$$

$$\text{Custom duty paid} = 10 \%$$

$$\text{Total duty paid} = \text{Principal amount} \times \text{percent rate}$$

Put values

$$\text{Total duty paid} = 7200 \times 10 \%$$

$$= 7200 \times \frac{10}{100} = 720 \text{ rupees.}$$

$$\text{Total price of T.V.} = 7200 + 720 = 7920 \text{ rupees.}$$

Q.8: Make the following conversations .

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

- (i) 10,000 PKRs in US dollars .
(ii) 1000 yen in US dollars .
(iii) 1000 yen in UK Pounds.
(iv) 50,000 Qatar Riyals in PKRs.
(v) 10,000 PKRs. in Euro .

Ans: (i) As 80 PKRs = 1 US dollar

$$1 \text{ PKRs} = \frac{1}{80} \text{ US dollar}$$

$$10000 \text{ PKRs} = \frac{1}{80} \times 10000 = \frac{8000}{8} \\ = 1000 \text{ US dollars.}$$

(ii) As

$$1 \text{ Yen} = 0.0142 \text{ US dollar} \\ 1000 \text{ Yen} = 0.0142 \times 1000 \\ = 14.2 \text{ US dollars.}$$

(iii) As

$$1 \text{ Yen} = 0.0086 \text{ pounds} \\ 1000 \text{ Yen} = 0.0086 \times 1000 \\ = 8.6 \text{ UK Pounds.}$$

(iv) As 1 Qatar Riyals = 122 PKRs

$$50,000 \text{ Qatar Riyals} = 122 \times 50000 \\ = 6100000 \text{ PKRs.}$$

(v) As 114 PKRs = 1 Euro

$$1 \text{ PKRs} = \frac{1}{114} \text{ Euro}$$

$$10000 \text{ PKRs} = \frac{1}{114} \times 10000 \\ = 87.72 \text{ Euro}$$

Q.9: Salim took loan from a commercial bank in the following manner . Rs. 20,000 for 20 days , Rs.10,000 for 15 days and Rs. 30,000 for 25 days .If the Markup is 12 % , then compute the total mark up .

Ans: Salim took loan for 20 days = Rs. 20,000

$$\text{Product} = \text{Loan} \times \text{number of days}$$

$$\Rightarrow \text{product} = 20,000 \times 20 = 400,0000 \text{ rupees.}$$

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

$$\text{As Mark up} = \frac{\text{products} \times \text{Rate of Markup}}{100 \times 365}$$

Put values

$$\text{Mark up} = \frac{400000 \times 12}{100 \times 365}$$

$$\text{Mark up} = 131.50 \text{ rupees}$$

Salim took loan for 15 days = Rs. 10,000

$$\Rightarrow \text{product} = 10,000 \times 15 = 15,0000 \text{ rupees.}$$

$$\text{Mark up} = \frac{150000 \times 12}{100 \times 365} = 49.31$$

Salim took loan for 25 days = Rs. 30,000.

$$\Rightarrow \text{product} = 30,000 \times 25 = 75,0000 \text{ rupees.}$$

$$\text{Mark up} = \frac{750000 \times 12}{100 \times 365} = 246.57 \text{ rupees}$$

$$\text{Total mark up} = 131.50 + 49.31 + 246.57 \\ = 427.38 \text{ rupees.}$$

Insurance : If a person purchased an insurance policy , he or she must pay equal installments for the policy on monthly basis , quarterly basis , after six months or annual basis . The person will get its bonus on fifth year and will continue till the maturity of the policy . The detail of the bonus is given in the following table .

	For first five Policy years Rs	From sixth Policy year to 16 th policy	From 17 th policy onwards
Whole life endowments	60	110	150
20 years and over	50	94	130
15 – 19 Years	35	81	81
14 years and less	20	66	

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Exercise 4.2:

Q.1: Mr. Ali purchased a term policy for 10 years of Rs. 50,000 on annual premiums. Find how much he will Pay per annum. Also calculate the amount of bonus for for first five years ? .

Ans: The value of Ali policy = Rs 50000

Term of policy = 10 years .

$$\text{Per annum , payment} = \frac{50000}{10} = 5000 \text{ rupees .}$$

bounce for first five years = 20 rupees per thousand

$$\text{Bounce for 5 years} = \frac{\text{Total amount} \times \text{Rate of bounce}}{1000}$$

Put values

$$\begin{aligned} \Rightarrow \text{Bounce for 5 years} &= \frac{50000 \times 20}{1000} \\ &= 50 \times 20 = 1000 \text{ rupees.} \end{aligned}$$

Q.2: If a person paying monthly premium installment of Rs. 500 for 20 years. Calculate the bounce of 20 years. How much he will get after maturity of his policy which is Rs.100000 ? .

Ans: The value of Ali policy = Rs 100000

Term of policy = 20 years .

Since the term of policy is 20 years then bounce is 50 rupees per thousand .

Bounce for first five years = 50 rupees per thousand

$$\text{Bounce for 5 years} = \frac{\text{Total amount} \times \text{Rate of bounce}}{1000}$$

Put values

$$\begin{aligned} \Rightarrow \text{Bounce for 5 years} &= \frac{100000 \times 20}{1000} \\ &= 100 \times 50 = 5000 \text{ rupees.} \end{aligned}$$

Bounce for 6th to 16 years = 94 rupees per thousand

$$\text{Bounce} = \frac{\text{Total amount} \times \text{Rate of bounce}}{1000}$$

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

Put values

$$\Rightarrow \text{Bounce} = \frac{100000 \times 94}{1000} = 100 \times 94 = 9400 \text{ rupees.}$$

Bounce for last 4 years = 130 rupees per thousand

$$\text{Then Bounce} = \frac{100000 \times 130}{1000} = 100 \times 130 = 13000 \text{ rupees.}$$

$$\text{Total bounce} = 5000 + 9400 + 13000 = 27400 \text{ rupees.}$$

Q.3: Saima purchased a whole life insurance policy of Rs. 50,000 and paid yearly installments of Rs. 1000. After 10 years she lost both eyes in car accident. How much bounce she would get for the first 10 years and how much will the company pay to her.

Ans: The value of Saima policy = Rs 50000

Term of policy at the time of accident = 10 years.

Bounce for first five years = 60 rupees per thousand

$$\text{Bounce for 5 years} = \frac{\text{Total amount} \times \text{Rate of bounce}}{1000}$$

Put values

$$\Rightarrow \text{Bounce for 5 years} = \frac{50000 \times 60}{1000} = 50 \times 60 = 3000 \text{ rupees.}$$

Bounce for next five years = 110 rupees per thousand

$$\text{Bounce for 5 years} = \frac{\text{Total amount} \times \text{Rate of bounce}}{1000}$$

Put values

$$\Rightarrow \text{Bounce for next 5 years} = \frac{50000 \times 110}{1000} = 50 \times 110 = 5500 \text{ rupees.}$$

$$\text{Total bounce} = 5500 + 3000 = 8500 \text{ rupees.}$$

$$\text{Total payment from company} = 50000 + 50000 + 8500 = 108550 \text{ rupees.}$$

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Q.4: Shazia purchased a term policy of for 10 years on annual installment basis which is Rs. 1000 per year and Robina purchased a term policy for 10 years on monthly basis premium installment which is Rs. x per month. If the worth of policy is Rs. 10,000, then find the following :

- (i) x
- (ii) Profit of Robina and Shazia .
- (iii) Who will get more benefit

Ans: The value of Shazia policy = Rs. 10,000

Term of Shazia policy = 10 years

Bounce for first five years = 20 rupees per thousand

$$\text{Bounce for first 5 years} = \frac{\text{Total amount} \times \text{Rate of bounce}}{1000}$$

Put values

$$\begin{aligned} \Rightarrow \text{Bounce for 5 years} &= \frac{10000 \times 20}{1000} \\ &= 10 \times 20 = 200 \text{ rupees.} \end{aligned}$$

Bounce for next five years = 66 rupees per thousand

$$\text{Bounce for 5 years} = \frac{\text{Total amount} \times \text{Rate of bounce}}{1000}$$

Put values

$$\begin{aligned} \Rightarrow \text{Bounce for next 5 years} &= \frac{10000 \times 66}{1000} \\ &= 10 \times 66 = 660 \text{ rupees.} \end{aligned}$$

Total bounce = 200 + 660 = 860 rupees .

Total payment from company = 50000 + 50000 + 8500
 = 108550-rupees .

The value of Robina policy = Rs. 10,000

Term of Robina policy = 10 years

$$(i) \text{ Term of Robina policy per month} = \frac{\text{Total amount}}{\text{years} \times \text{months}}$$

Put values

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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$$\begin{aligned}\text{Term of Robina policy per month} &= \frac{10000}{12 \times 10} \\ &= 83.33 \text{ rupees,}\end{aligned}$$

Thus $x = 83.33$ rupees.

- (ii) Since the term and amount of shaziz and Robina are same, Since Shazia bounce = 860 rupees
 Then also Robina bounce = 860 rupees.

- (iii) Both have the same benefit.

Q.5: An insured car costs Rs. 10,00,000. If a borrower paid 20% of the car price as a part of his equity. Compute the amount of the initial amount. If the time is fixed as 5 years, calculate the per month installment to be paid. If the installment are equal.

Ans: Total value of car = 10,00,000.

Initial payment paid = 20%

$$\text{Total initial amount} = 1000000 \times 20\%$$

$$= 1000000 \times \frac{20}{100}$$

$$= 100000 \times 20$$

$$= 200000$$

$$\begin{aligned}\text{The remaining amount of car} &= 1000000 - 200000 \\ &= 800000 \text{ rupees.}\end{aligned}$$

The term of payment = 5 years.

$$\text{Monthly installment} = \frac{\text{Remaining amount}}{\text{years} \times \text{months}}$$

$$= \frac{800000}{12 \times 5}$$

$$= 13333.3 \text{ rupees.}$$

Exercise 4.3:

Q.1: A person purchased a car for Rs. 500,000 through bank and paid 20% as down payment to the bank. If Rs. 250 is paid government fixed charges every month. How much will the person pay per month if the period is 5 years and installments are equal.

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Ans: The value of car = 500000 rupees .

Initial payment paid = 20%

Total initial amount to be paid = $500000 \times 20\%$

$$= 500000 \times \frac{20}{100}$$

$$= 5000 \times 20$$

$$= 100000$$

The remaining amount of car = $500000 - 100000$

$$= 400000 \text{ rupees.}$$

The term of payment = 5 years .

Monthly installment = $\frac{\text{Remaining amount}}{\text{years} \times \text{months}}$

$$= \frac{400000}{12 \times 5}$$

$$= 6666.6 \text{ rupees.}$$

Q.2: Khadim Ali is a farmer who purchased a tractor . If the bank contributes the whole cost which 1200000 .

When will he own the tractor if he pays Rs. 6000 per month as a part of his share to the bank .

Ans: The value of tractor = 1200000 rupees .

Monthly installment = 6000 rupees .

$$\text{The term at which installment is finished} = \frac{1200000}{6000}$$

$$= 200 \text{ months}$$

Thus after 200 months khadim Ali own the tractor

Or 16 years and 8 months .

Q.3: The price of a car is Rs.450,000 in the open market but it is given to a borrower for Rs.600000 for repayment on monthly installments .How much more amount is paid as compared to the open market . Calculate the processing charges at the rat of 1.5 % of the cost .

Ans: The value of car in open market = 450,000 rupees

The value of car in monthly installment = 600000 rupees

Amount is paid more in installment as compared to

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

$$\begin{aligned}\text{open Market} &= 600000 - 450,000 \\ &= 150000 \text{ rupees.}\end{aligned}$$

$$\text{charges at the rate} = 1.5 \%$$

$$\begin{aligned}\text{Total charges} &= \text{total amount} \times \text{percent} \\ &= 600000 \times 1.5 \% \\ &= 600000 \times \frac{1.5}{100} \\ &= 6000 \times 1.5 \\ &= 9000 \text{ rupees.}\end{aligned}$$

Exercise 4.4 (Objective Type Questions)

Q.1: Encircle T for True F for False in each of the following questions.

- (i) In current account no profit is given T / F
 - (ii) PLS term deposit is not an account T / F
 - (iii) ATM card is used for purchased T / F
 - (iv) Cheque is not negotiable instrument T / F
 - (v) Pakistani currency is used to purchase in item in USA T / F
 - (vi) Insurance means defense T / F
 - (vii) Leasing is a product of Islamic banking T / F
 - (viii) Down payment is the half price of an asset T / F
 - (ix) Life insurance is purchased for Rs 200000 only T / F
- Answers:** (i) T (ii) F (iii) F (iv) T (v) F (vi) F
(vii) F (viii) F (ix) T

Q.2: Three suggested answers are given for each question
Choose the correct one .

- (i) All commercial banks have
 - (a) One function
 - (b) Two functions
 - (c) Three functions
- (ii) Cards used for domestic purchasing are
 - (a) ATM
 - (b) Debit
 - (c) Credit
- (iii) Mark up is the profit received by
 - (a) Customer
 - (b) Bank
 - (c) Government
- (iv) Leasing is a product of
 - (a) Cooperative unions
 - (b) Islamic banks

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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(c) State bank of Pakistan

(v) In AIB (Accident Insurance Benefit) policy , if a finger is cut , then the company pays to the customer

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$ (c) $\frac{1}{3}$

(vi) In Musharaka part of the borrower is

(a) Equal (b) More (c) Not fixed

(vii) PKRs is heavier than

(a) Dollar (b) Pound (c) Yen

(viii) Vehicle incurrence is for

(a) Protection of Driver (b) Protection of car
(c) Protection of life.

(ix) Yen is the currency of

(a) America (b) China (c) Japan.

Answers: (i) b (ii) c (iii) b (iv) c (v) b
(vi) c (vii) c (viii) b (ix) c

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

UNIT – 5:

Consumer Mathematics.

Sales tax : $\text{Sales Tax} = \text{Rate} \times \text{Price}$

Where Rate = percentage

Excise duty : $\text{Rate} \times \text{Price of the item}$

Property tax: $\text{Property tax} = \text{Rate} \times \text{value of the property}$

Calculating the amount of Income tax on the individual

With fixed income:

Income slabs	Taxable income	Amount to be subtract	Remaining amount	Tax rate	Income tax	Gross Income tax
Up to 150000	100000	80000	20000	7.5%	1500	1500
150000-300000	225000	150000	75000	12.5%	9375	9375 + 1500 = 10875
300000-400000	350000	300000	50000	20%	10000	10000 + 10875 = 20875
400000-700000	550000	400000	150000	25%	37500	37500 + 20875 = 58375
Above 700000	1000000	700000	300000	35%	105000	105000 + 58375 = 163375

Calculating the amount of income tax imposed on a salaried Person (government employer)

Income Slabs	Reduction rates from Gross Income
60000 – 80000	By 7%
80001 – 100,000	By 60%
100,001 – 150,000	By 50%
150,001 – 200,000	By 40%
200,001 – 300,000	By 30%
300,001 – 500,000	By 20%
500,001 – 100,000,0	By 10%
Above 100,001	By 5%

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Exercise 5.1:

Q.1: A person bought a new car that cost Rs. 300000 .If
Sales tax 7 % . what is the total amount that the person
must pay ?

Solution: The cost of car = 300000 rupees

Sales tax = 7 %

Since Sales Tax = Rat \times Price put values

$$\text{Sales Tax} = 7\% \times 300000 .$$

$$= \frac{7}{100} \times 300000$$

$$= 7 \times 3000 = 21000 \text{ rupees.}$$

$$\text{Total amount will be paid} = 300000 + 21000$$

$$= 321000 \text{ rupees .}$$

Q.2: Saima bought a p - 4 computer system on sale for
Rs. 20,000 and paid a total of Rs.21,500 .How much
sales tax did she pay ? . Also find the tax rate .

Solution: Original cost = 20000

The amount paid = 21500

Tax = amount paid - Original cost

$$\Rightarrow \text{Tax} = 21500 - 20000 = 1500$$

Thus total tax = 1500 rupees .

Now Total Tax = original cost \times tax rate , put values

$$\Rightarrow 1500 = 20000 \times \text{tax rate}$$

$$\Rightarrow \text{Tax rate} = \frac{1500}{20000} = \frac{15}{200}$$

$$\text{Tax rate percent} = \frac{15}{200} \times 100$$

$$= \frac{15}{2} \% = 7.5\%$$

Q.3: If the excise duty (tax) is 20 % of the market value
of any car registered in Pakistan . How much excise
tax would a parson pay on a car with a market value
of Rs.1000000 ? .

Solution: Market value of car = 1000000 rupees.

Excise duty (tax) = 20 %

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

$$\text{Tax} = \text{cost} \times \text{tax rate} \quad \text{put value}$$

$$\Rightarrow \text{Tax} = 1000000 \times 20\%$$

$$\Rightarrow \text{Tax} = 1000000 \times \frac{20}{100} = 10000 \times 20 = 200000 \text{ rupees.}$$

Q.4: An artist bought art supplies totaling Rs.7000 and had to pay a sales tax of Rs.301. What is the tax rate?

Solution: bought price = 7000 rupees

$$\text{Sales tax} = 301$$

Now Total Tax = bought cost \times tax rate, put values

$$\Rightarrow 301 = 7000 \times \text{tax rate}$$

$$\Rightarrow \text{Tax rate} = \frac{301}{7000}$$

$$\begin{aligned} \text{Tax rate percent} &= \frac{301}{7000} \times 100 \\ &= \frac{301}{70} \% = 4.3\% \end{aligned}$$

Q.5: A cotton contains 10 small packs costs for Rs. 300.

How much a consumer will pay to buy a pack if the government imposed an excise duty by 25 % on a pack.

Solution: The value of 10 packs = 300 rupees.

$$\text{The value of 1 pack} = \frac{300}{10} = 30 \text{ rupees.}$$

$$\text{Tax rate} = 25\%$$

Total Tax = bought cost \times tax rate, put values

$$\Rightarrow \text{Total tax} = 30 \times 25\%$$

$$\Rightarrow \text{Total tax} = 30 \times \frac{25}{100} = 3 \times \frac{25}{10} = \frac{75}{10} = 7.5 \text{ rupees.}$$

$$\Rightarrow \text{Total value of one pack} = 30 + 7.5 = 37.5 \text{ rupees.}$$

Q.6: Arif bought a plot of size 60×40 , If 1 square foot costs Rs 200, then find the value of the plot, also find the amount of the tax at the rate of 5 %.

Solution: Area of plot = 60×40

$$= 2400 \text{ square feet.}$$

$$\text{Cost of 1 square foot} = 200 \text{ rupees.}$$

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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$$\begin{aligned}\text{Total cost of the plot} &= 2400 \times 200 \\ &= 480000 \text{ rupees.}\end{aligned}$$

$$\text{Tax rate} = 5\%$$

$$\text{Total Tax} = \text{bought cost} \times \text{tax rate}, \text{ put values}$$

$$\Rightarrow \text{Total tax} = 480000 \times 5\%$$

$$\Rightarrow \text{Total tax} = 480000 \times \frac{5}{100} = 4800 \times 5 = 24000 \text{ rupees.}$$

Q.7: Nadia Gul purchased a newly constructed house through a property dealer. She paid the total amount Rs. 25,00,000 including the dealer commission Rs. 50,000. Calculate the amount of tax rate 5%.

Solution: Cost of house with commission = Rs. 25,00,000

$$\text{Commission} = \text{Rs. } 50,000$$

$$\begin{aligned}\text{Original cost of house} &= 25,00,000 - 50,000 \\ &= \text{Rs. } 24,50,000\end{aligned}$$

$$\text{Tax rate} = 5\%$$

$$\text{Total Tax} = \text{bought cost} \times \text{tax rate}, \text{ put values}$$

$$\Rightarrow \text{Total tax} = 24,50,000 \times 5\%$$

$$\text{Total tax} = 24,50,000 \times \frac{5}{100} = 24,500 \times 5 = 1,22,500 \text{ rupees.}$$

Q.8: A business man earned Rs. 3,00,000 in 2004.

Calculate the income tax amount.

Solution: Total income of business man = Rs. 3,00,000.

First 1,50,000 taxable amount 75,000 rupees. Then tax will be paid = Rs. 5,250

The remaining 1,50,000 rupees the tax will be paid at the rate of 12.5% = $1,50,000 \times 12.5\%$

$$= 1,50,000 \times \frac{12.5}{100} = 1,500 \times 12.5$$

$$= 18,750 \text{ rupees.}$$

$$\text{Thus total tax} = 5,250 + 18,750 = \text{Rs. } 24,000$$

Q.9: Ali is a teacher in a public sector university. If his basic is Rs. 1,70,800. The total gross salary 01-07-2006 to 30-06-2007, including evening shift remuneration is Rs. 4,07,415. Income tax deducted is Rs. 8,000. How

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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much tax he would pay more ? .

Solution: Total gross salary = 407415 rupees .

Income tax deducted is = Rs. 8502

On 400000 rupees taxable amount = $407415 - 400000$
 = 7415 rupees .

Rate of tax = 25 %

Tax = $7415 \times 25\%$

$= 7415 \times \frac{25}{100} = 1853.75$ rupees.

Total amount of income tax calculating = $44000 + 1853.75$
 = 45853.75 rupees.

Rate of tax = 20%

Total tax = $45853.75 \times 20\%$

$= 45853 \times \frac{20}{100} = 9170.75$ rupees.

The remaining tax = $9170.75 - 8502 = 668.75$ rupees.

GST rate = 17 % and pty charges = 35 rupees.

Calculating the amount of bill for electricity :

(a) For domestic consumers : Variable charges (including sales tax and other charges) in case of different slabs are given in the following tables.

S.No.	Slabs in (units)	Variable charges Rs / Kwh
1	1 – 50	Rs. 2.00 / unit
2	51 – 100	Rs. 5.79 / unit
3	101 – 200	Rs. 8.11 / unit
4	201 – 300	Rs. 10.20 / unit
5	301 – 700	Rs. 16.00 / unit
6	Above 700	Rs. 18.00 / unit

(b) For commercial consumers :

Per unit = Rs. 18.00

(c) For Industrial consumers :

Per unit = Rs. 9.00

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

Gas Bill: To calculate the amount of a gas bill, some important formulas and slabs are given

(i) HM^3 (Hecto Cubic meter) : It is the unit of gas volume which is calculated by the following formula,

$$HM^3 = \frac{\text{Present reading} - \text{Previous reading}}{100,000}$$

(ii) MMBTU (Milli Million British Thermal Unit) :

It is the unit of energy. The Gas Volume (HM^3) is converted into MMBTU by the following formula

$$MMBTU = \frac{\text{Gas volume} \times GCV}{281.7385}$$

Where GCV means Gas Calorific Value. It is not fixed and changes time by time.

(iii) Gas slabs:

Slab	Usage of gas (HM^3)	Rs per MMBTU
1	Up to 1.00	110.00
2	Over 1 to 3	220.00
3	Above 3	600.00

(iv) Slab is calculated by the formula

$$\text{Slab} = \frac{\text{Gas volume} (HM^3) \times 30}{\text{No. of days}}$$

(v) Meter rent Rs. 20 for 30 days.

Telephone bills: In Telephone bills some charges are fixed, which are below. GST = 21 % of the subtotal

Line rent = Rs. 199 per month.

NWD call per unit cost = Rs. 2

NWD mobile call per unit cost = Rs. 2.5

Local mobile call per unit cost = Rs. 2.5

Cellular phone charges: There are two types connections in cellular phone (a) Pre paid (b) Post paid

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

In both cases 21 % are deducted .

(a) Pre paid connection:

(1) Simple package :

- (i) Call charges within the network = Rs. 1 per minute .
- (ii) Call charges on the other network = Rs. 1.60 per minute
- (iii) SMS charges within the network = Rs.0.50 SMS .
- (iv) SMS charges on the other network = Rs. 1 per SMS

(2) 3 Minute package :

- (i) Call charges within the network = Rs. 2 for 3 minute .
- (ii) Call charges on the other network = Rs.3.20 per 3 minute
- (iii) SMS charges within the network = Rs.0.50 SMS .
- (iv) SMS charges on the other network = Rs. 1 per SMS

(b) For post paid connection :

- (i) Monthly line rent = Rs. 499 .
- (ii) Call charges within the network = Rs. 0.50 for 30 seconds
- (iii) Call charges on the other network = Rs.1.40 per 30 seconds
- (iv) Call charges to PTCL and WWL networks
= Rs. 1.20 for 30 seconds
- (v) SMS charges within the network = Rs.0.50 per SMS .
- (vi) SMS charges on the other network = Rs. 1 per SMS
- (vii) International SMS = Rs. 1.50 per SMS.

Exercise 5.2:

Q.1: Calculate the cost of the following domestic electricity consumed units (using variable charges only) .

(i) 50 units (ii) 64 units (iii) 100 units (iv) 150 units

Solution: (i) First 50 units charges = $50 \times 2 = 100$ rupees.

(ii) 64 units: First 50 units charges = $50 \times 2 = 100$ rupees.

Remaining units = $64 - 50 = 14$

Next 14 units charges = $14 \times 5.79 = 81.06$ rupees.

Total charges = $100 + 81.06 = 181.06$ rupees .

(iii) 100 units: First 50 units charges = $50 \times 2 = 100$ rupees.

Remaining units = $100 - 50 = 50$

Next 50 units charges = $50 \times 5.79 = 289.5$ rupees.

Total charges = $100 + 289.5 = 389.5$ rupees .

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(iv) 150 units:

First 50 units charges = $50 \times 2 = 100$ rupees

Next 100 units charges = $100 \times 5.79 = 579$ rupees.

Total charges = $100 + 579 = 689$ rupees .

Q.2: Find the total cost of 80 units (commercial) including
FED @ 17 % and income tax @ 18 % .

Solution: Total Unit = 80

Commercial charges per unit = 18 rupees.

80 Units charges = $18 \times 80 = 144$ rupees.

Rate of FED = $17 \% = \frac{17}{100} \times 144 = 24.48$ rupees.

Rate of Income tax = $18 \% = \frac{18}{100} \times 144 = 25.92$ rupees.

Total charges = $144 + 24.48 + 25.92 = 2760.48$ rupees.

Q.3: Asim living in a small town . His previous meter
reading was 15860 and present reading is 15900 .

Calculate the total cost of his electricity bill .

Solution: Previous meter reading = 15860

Present meter reading = 15900

Uses Units = $15900 - 15860 = 40$

Charges of 40 units = $40 \times 2 = 80$ rupees.

Rate of GST = $17 \% = \frac{17}{100} \times 80 = 13.6$ rupees.

Rate of Income tax = $18 \% = \frac{18}{100} \times 80 = 14.4$ rupees.

Total charges = $80 + 13.6 + 14.4 = 108$ rupees.

Q.4: In the month of October saima consumed 150 units
of electricity and in the month of November due to less
consumption she consumed 120 units . Find the amount
of each bill and tell how much money she saved in
November .

Solution: In October consumed units = 150

First 50 units charges = $50 \times 2 = 100$ rupees

Next 100 units charges = $100 \times 5.79 = 579$ rupees.

charges in October = $100 + 579 = 689$ rupees .

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

$$\text{Rate of GST} = 17\% = \frac{17}{100} \times 689 = 117.3 \text{ rupees.}$$

$$\text{Rate of Income tax} = 18\% = \frac{18}{100} \times 689 = 124.02 \text{ rupees.}$$

$$\begin{aligned} \text{Total charges in October} \\ = 689 + 117.3 + 124.02 = 930.32 \text{ rupees.} \end{aligned}$$

In November consumed units = 120

$$\text{First 50 units charges} = 50 \times 2 = 100 \text{ rupees}$$

$$\text{Next 100 units charges} = 70 \times 5.79 = 405.3 \text{ rupees.}$$

$$\text{charges in November} = 100 + 405.3 = 505.3 \text{ rupees.}$$

$$\text{Rate of GST} = 17\% = \frac{17}{100} \times 505.3 = 68.901 \text{ rupees.}$$

$$\text{Rate of Income tax} = 18\% = \frac{18}{100} \times 505.3 = 90.954 \text{ rupees.}$$

$$\begin{aligned} \text{Total charges in November} \\ = 505.3 + 68.901 + 90.954 = 665.155 \text{ rupees.} \end{aligned}$$

$$\begin{aligned} \text{Saved money} &= \text{October charges} - \text{November charges} \\ &= 930.32 - 665.155 = 265.165 \text{ rupees.} \end{aligned}$$

Q.5: The previous and present readings on a domestic consumer gas bill are 15266100, 15644200. Find the following if GCV 950 BTU/SCF and 3 numbers of days are (i) consumed units in HM^3 (ii) consumed units in MMBTU (iii) Different slabs (iv) Total cost of the bill.

Solution: Previous reading = 15266100

Present reading = 15644200

$$\begin{aligned} \text{Consumed units} &= 15644200 - 15266100 \\ &= 378100 \end{aligned}$$

(i) Consumed units in HM^3 =

$$\frac{\text{present reading} - \text{previous reading}}{100000}$$

$$\text{Consumed units in } HM^3 = \frac{378100}{100000} = 3.78100$$

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

$$(ii) \text{ Consumed units in 1 MMBTU} = \frac{GCV \times \text{Units in } HM^3}{281.7385}$$

$$= \frac{950 \times 3.78100}{281.7385} = 12.74 \text{ Units}$$

(iii) Now we find slabs

$$\text{Slab} = \frac{\text{gas volume}(HM^3) \times \text{Number of days}}{30}$$

$$\Rightarrow \text{Slab} = \frac{3.78100 \times 3}{30} = 0.378$$

It is in the first slab .

(iv) Charges of first slab per unit = 110 rupees .

Charges of 12.74 units = $12.74 \times 110 = 1401.4$ rupees .

Meter charges on 3 days = $\frac{20}{30} \times 3 = 2$ rupees.

Charges on gas = $1401.4 + 2 = 1403.4$ rupees .

Rate of GST = 17 % = $\frac{17}{100} \times 1403.4 = 238.578$ rupees.

Total cost of bill = $1403.4 + 238.578$
 = 1641.978 rupees.

Q.6: If consumed gas in $HM^3 = 1.451$, convert into

MMBTU , where $1 \text{ MMBTU} = \frac{GCV \times \text{Units in } HM^3}{281.7385}$

and $GCV = 990 \text{ BTU/SCF}$.

Solution: Consumed gas in $HM^3 = 1.451$

$GCV = 990 \text{ BTU / SCF}$

As $1 \text{ MMBTU} = \frac{GCV \times \text{Units in } HM^3}{281.7385}$

$$\text{Gas consumed in MMBTU} = \frac{990 \times 1.451}{281.7385}$$

$$= 5.098$$

$$\text{OR} = 5.10$$

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Q.7: The previous and present local calls meter readings are 2515 and 3015. Calculate the total dues of the telephone bill.

Solution: Previous reading = 2515

Present reading = 3015

Total consumed units = $3015 - 2515 = 500$

Charges of 1 unit = 2 rupees.

Charges of 500 units = $500 \times 2 = 1000$ rupees.

Line rent = 199 rupees.

Sub Total charges = $1000 + 199 = 1199$ rupees.

GST on 21 % = $\frac{21}{100} \times 1199 = 251.79$ rupees.

Total dues of telephone bill = $1199 + 251.79$
= 1450.79 rupees.

Q.8: In a domestic consumer bill consumed units were given as following. Local call units = 70,

NWD calls units = 50, NWD mobile calls units = 20.

What was the total charges of the bill included FED and line rent ?

Solution: Local call units = 70

Charges of 1 local call unit = 2 rupees.

Charges of 70 units = $70 \times 2 = 140$ rupees.

NWD calls units = 50

Charges of 1 NWD call unit = 2 rupees.

Charges of 50 NWD units = $50 \times 2 = 100$ rupees.

NWD mobile calls units = 20

Charges of 1 NWD mobile call unit = 2.5 rupees.

Charges of 20 NWD mobile units = $20 \times 2.5 = 50$ rupees.

Line rent = 174 rupees.

Sub Total charges = $140 + 100 + 50 + 174 = 464$ rupees.

GST on 21 % = $\frac{21}{100} \times 464 = 97.44$ rupees.

Total dues of bill = $464 + 97.44$
= 561.44 rupees.

Q.9: A person has prepaid connection with Rs. 75 in the

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Balance. He consumed 5 minutes and 35 seconds for calls. How much deducted from his balance.

Solution : Total amount in the balance = 75 rupees.

Total time = 5 minutes and 35 seconds = 6 minutes

Call charges within the network per minute = 1 rupee.

Call charges within the network = $6 \times 1 = 6$ rupees.

Remaining balance = $75 - 6 = 69$ rupees.

Call charges with other network per minute = 1.60 rupee.

Call charges with other network = $6 \times 1.60 = 9.6$ rupees.

Remaining balance = $75 - 9.6 = 65.4$ rupees.

Q.10: The cost of cellular phone consumer is Rs. 75.5 including Rs. 70 call charges and 5.5 SMS charges. How much balance would be in his credit if he has loaded Rs. 100 card.

Solution: Loaded balance = 100 rupees.

GST on 21 % = $\frac{21}{100} \times 100 = 21$ rupees.

Calls and SMS charges = $70 + 5.5 = 75.5$ rupees.

Total charges = $75.5 + 21 = 96.5$ rupees.

Remaining balance = $100 - 96.5 = 3.5$ rupees.

Exercise 5.3:

Q.1: The daily wages of a labour in premier chip board factory is Rs. 120. Find his weekly income if he works for 6 days.

Solution: Daily wage = Rs. 120.

Income of 6 days = $6 \times 120 = 720$ rupees.

His weekly income = 120 rupees.

Q.2: A worker is given Rs. 120 a day. If he worked on Sunday he would be given Rs. 220. Calculate his monthly income.

Solution : Daily wage = Rs. 120.

Income of 6 days = $6 \times 120 = 720$ rupees.

On Sunday daily wage = Rs. 220.

One week income = $720 + 220 = 940$ rupees.

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Monthly income = $4 \times 940 = 3760$ rupees.

Q.3: Arif khan is working in a glass industry and getting Rs. 177 for 12 hrs. If the wages for 8 hrs is Rs. 120 ,how much he is getting more for 4 hrs as overtime ? . Also find his annual income , if he worked 6 days in a week .

Solution: For 12 hrs daily wages = Rs. 177 .

For 8 hrs daily wages = Rs. 120 .

Over times for 4 hrs = $177 - 120 = 57$ rupees .

Weekly income = $6 \times 177 = 1062$ rupees.

Monthly income = $4 \times 1062 = 4248$ rupees .

Annual income = $12 \times 4248 = 50976$ rupees.

Q.4: A sales clerk for a man's clothing store earned Rs. 1500 commission last week .What is his weekly income would be if his regular pay is Rs. 6000 per month ? .

Solution : Monthly salary of sales man = Rs. 6000 .

Commission = Rs. 1500

Total income of monthly = $6000 + 1500 = \text{Rs. } 7500$

1 day income = $\frac{7500}{30} = \text{Rs. } 250$

Weekly income = $250 \times 7 = \text{Rs. } 1750$

Q.5: Muhammad Afzal is working in a university . His basic pay Rs. 11,000 medical allowance is Rs . 3500 per month and conveyance allowance is Rs. 700 per month . Calculate his annual gross income .

Solution: Muhammad Afzal basic pay = Rs. 11,000

Medical allowance = Rs . 3500

Conveyance allowance = Rs. 700

Total salary = $11000 + 3500 + 700 = \text{Rs. } 15200$

Annual gross income = $12 \times 15200 = \text{Rs. } 182400$

Q.6: Mr. Akram is in (B.P.S. 10) . Calculate his gross income if he is getting basic pay Rs. 3295 , medical allowance is Rs. 3500 , house rent allowance at the rate of 45 % of the basic pay and conveyance allowance is Rs. 920 per month .

Solution: Akram basic pay = Rs. 3295 .

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Medical allowance = Rs. 3500

House rent at 45 % = $\frac{45}{100} \times 3295 = \text{Rs. } 1482.75$

Conveyance allowance = Rs. 920 .

Monthly salary = $3295 + 3500 + 1482.75 + 920$
= Rs. 9197.75 .

Annual salary = $12 \times 9197.75 = \text{Rs. } 110373$.

Q. 7: The basic pay of a person is Rs. 4115 , medical allowance is Rs. 3500 , Conveyance allowance is Rs. 1360 . Find his grand total annual income .

Solution: Basic pay = Rs. 4115

Medical allowance = Rs. 3500

Conveyance allowance = Rs. 1360

Monthly income = $4115 + 3500 + 1360$
= Rs . 8975

Annual income = $12 \times 8975 = \text{Rs. } 107700$

Exercise 5.4:

(Objective types Questions)

Q.1: Encircle T for true statement and F for false statement in each case .

(i) Sales tax is levied on property T / F

(ii) Property tax is a percent of assessed property value T / F

(iii) For domestic consumer cost of one electricity unit is Rs. 7.86 T / F

(iv) Amount of a bill is calculated if only present reading is given T / F

(v) Cost of a local call is Rs . 2 per unit .

Answers: (i) F (ii) T (iii) F (iv) F (v) T

Q.2: Three suggested answers are given for each question

Choose the correct one and write the answer in the form a , b , c in the box .

(i) Electricity duty is imposed on

(a) cooking oil (b) Vegetables (c) Cigarettes

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- (ii) NWD mobile call rate per unit is Rs.
(a) 2 (b) 2.5 (c) 4
- (iii) Line rent charges for all telephone bills is
(a) Rs. 74 (b) Rs. 174 (c) Rs. 176
- (iv) In cellular phones in respect of prepaid connection deduction is
(a) 15 % (b) 21 % (c) 30 %
- (v) Gas is measured in
(a) HM^3 (b) HM^2 (c) H^3M
- (vi) property tax =
(a) Rate + value property (b) Rate - value property
(c) Rate \times value property .
- (vii) Gross income is the income of
(a) A week (b) A month (c) A year
- Answers : (i) c (ii) b (iii) b (iv) b (v) a (vi) c (vii) c**

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UNIT: 6.

Radical and Radicand : When a real number is expressed in the form of $\sqrt[n]{a}$ then "n" is called Radical and "a" is called Redcand :

and $\sqrt[n]{a}$ is the radical form of the nth root of "a".

Note: If "a" is a constant and x is a variable then a^x is called exponential form of an expression

Transform redical form to exponential form :

If $\sqrt[n]{x^m} = x^{\frac{m}{n}}$ is exponential form .

Transform exponential form to redical form :

$x^{\frac{m}{n}} = \sqrt[n]{x^m}$ is the redical form .

Exercise 6.1.

Q.1: Write down the radicals and radicand for each of the following expressions .

(i) $\sqrt[3]{7}$ (ii) $\sqrt[4]{\frac{36}{25}}$ (iii) $\sqrt[5]{ab^2}$

(iv) $\sqrt[3]{xyz}$ (v) $\sqrt[6]{\frac{x}{5y^2}}$ (vi) $\sqrt[4]{256}$

Solution: (i) radical = 3 , radicand = 7

(ii) Radical = 4 , radicand = $\frac{36}{25}$

(iii) Radical = 5 , radicand = ab^2

(iv) Radical = 3 , radicand = xyz

(v) Radical = 6 , radicand = $\frac{x}{5y^2}$

(vi) Radical = 4 , radicand = 256

Q.2: Transform the following radical into exponential form .Do not simplify .

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$$(i) \sqrt{5} \quad (ii) \sqrt[n]{p} \quad (iii) \sqrt[3]{64} \quad (iv) \sqrt[3]{x^3 y}$$

$$(v) \sqrt[4]{\frac{x}{y}} \quad (vi) \sqrt[3]{81}$$

Solution : (i) As $\sqrt{5} = 5^{\frac{1}{2}}$

$$(ii) \sqrt[n]{p} = p^{\frac{1}{n}}$$

$$(iii) \text{ As } \sqrt[3]{64} = (64)^{\frac{1}{3}}$$

$$(iv) \sqrt[3]{x^3 y} = (x^3 y)^{\frac{1}{3}}$$

$$(v) \sqrt[4]{\frac{x}{y}} = \left(\frac{x}{y}\right)^{\frac{1}{4}}$$

$$(vi) \sqrt[3]{81} = (81)^{\frac{1}{3}}$$

Q.3 : Transform the following exponential form of ln Expression into radical form.

$$(i) x^2 \quad (ii) b^3 \quad (iii) (mn)^{\frac{1}{p}} \quad (iv) (36)^{\frac{1}{2}}$$

$$(v) (32)^{\frac{1}{3}} \quad (vi) (a^2 b^2 c)^{\frac{1}{4}}$$

Solution : (i) $x^2 = \sqrt{x^{2 \times 2}} = \sqrt{x^4}$

$$(ii) b^3 = \sqrt{b^{3 \times 2}} = \sqrt{b^6}$$

$$(iii) (mn)^{\frac{1}{p}} = \sqrt[p]{mn} \quad (iv) (36)^{\frac{1}{2}} = \sqrt{36}$$

$$(v) (32)^{\frac{1}{3}} = \sqrt[3]{32} \quad (vi) (a^2 b^2 c)^{\frac{1}{4}} = \sqrt[4]{a^2 b^2 c}$$

Laws of Exponents:

Base and Exponent: In x^n then x is base and n is Exponent .

Laws of Exponent : $\forall m, n \in N, a \in R$

$$(i) a^m \cdot a^n = a^{m+n}$$

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$$(ii) \frac{a^m}{a^n} = a^{m-n}$$

$$(iii) (a^m)^n = a^{mn}$$

$$(iv) \left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

$$(v) \text{ if } a^0 = 1, a \neq 0$$

Exercise 6.2:

Q.1 ; Write the base and exponent and value of the

following : (i) 2^3 (ii) $-b^6$ (iii) $\left(\frac{101}{200}\right)^{20}$

(iv) $(-100)^5$ (v) $(xy)^{-6}$ (vi) $10y^{-30}$

Solution: (i) Base = 2 and Exponent = 3

(ii) Base = b and Exponent = 6

(iii) Base = $\frac{101}{200}$ and Exponent = 20

(iv) Base = -100 and Exponent = 5

(v) Base = xy and Exponent = -6

(vi) Base = y and Exponent = -30

Simplify the following with the help of the laws of exponents.

Q.2: $a^3 \times a^5$

Solution : $a^3 \times a^5 = a^{3+5} = a^8$

Q.3: $100b^{10} \times 12b^7$

Solution : $100b^{10} \times 12b^7 = 100 \times 12b^{10+7}$
 $= 1200b^{17}$

Q.4: $(x)^3 \times (-x)^4$

Solution $(x)^3 \times (-x)^4 = x^3 \times x^4 = x^{3+4} = x^7$

Q:5: $-x^3y^3(-xy)^5$

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Solution: $-x^3y^3(-xy)^5 = -x^3y^3(-x^5y^5)$
 $= x^{3+5} \cdot y^{3+5} = x^8 \cdot y^8$ Ans

Q:6: $ab^2(b^2)^3$

Solution: $ab^2(b^2)^3 = ab^2 \cdot b^6$
 $= ab^{2+6} = ab^8$ Ans

Q:7: $(-2)^2(ab^4)^3(a^2b)^4$

Solution: $(-2)^2(ab^4)^3(a^2b)^4 = 4a^3(b^4)^3(a^2)^4b^4$
 $= 4a^3b^{12}a^8b^4$
 $= 4a^{3+8}b^{12+4} = 4a^{11}b^{16}$ Ans

Q:8: $\frac{x^5}{x^2}$

Solution: $\frac{x^5}{x^2} = x^{5-2} = x^3$

Q:9: $\frac{(2a^3b^4)^3}{(ab)^2}$

Solution: $\frac{(2a^3b^4)^3}{(ab)^2} = \frac{2^3a^9b^{12}}{a^2b^2}$
 $= 8a^{9-2}b^{12-2} = 8a^7b^{10}$ Ans

Q:10: $\left(1\frac{3}{4}\right)^3$

Solution: $\left(1\frac{3}{4}\right)^3 = \left(\frac{7}{4}\right)^3$
 $= \frac{7^3}{4^3} = \frac{343}{64}$

Q.11: $\left[64^{-\frac{2}{3}}\right]^{\frac{1}{2}}$

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Solution: $\left[64^{\frac{-2}{3}}\right]^{\frac{1}{2}} = (64)^{-\frac{1}{3}}$
 $= (4^3)^{-\frac{1}{3}} = 4^{-1}$
 $= \frac{1}{4}$

Q:12: $x^{\frac{2}{3}} \cdot x^{\frac{1}{6}}$

Solution: $x^{\frac{2}{3}} \cdot x^{\frac{1}{6}} = x^{\frac{2}{3} + \frac{1}{6}}$
 $= x^{\frac{4+1}{6}} = x^{\frac{5}{6}}$ Ans

Q:13: $\frac{(x^a)^b}{(x^c)^a} \times \frac{(x^b)^c}{(x^a)^b} \times \frac{(x^c)^a}{(x^b)^c}$

Solution: $\frac{(x^a)^b}{(x^c)^a} \times \frac{(x^b)^c}{(x^a)^b} \times \frac{(x^c)^a}{(x^b)^c} = \frac{x^{ab}}{x^{ca}} \times \frac{x^{bc}}{x^{ab}} \times \frac{x^{ca}}{x^{bc}}$
 $= x^{ab+bc+ca-ca-ab-bc}$
 $= x^0 = 1$ Ans

Q:14: $\left(\frac{x^{2a}}{x^{a+b}}\right) \cdot \left(\frac{x^{2b}}{x^{b+c}}\right) \cdot \left(\frac{x^{2c}}{x^{c+a}}\right)$

Solution: $\left(\frac{x^{2a}}{x^{a+b}}\right) \cdot \left(\frac{x^{2b}}{x^{b+c}}\right) \cdot \left(\frac{x^{2c}}{x^{c+a}}\right)$
 $= (x^{2a-a-b}) (x^{2b-b-c}) (x^{2c-c-a})$
 $= x^{a-b} \cdot x^{b-c} \cdot x^{c-a} = x^{a-b+b-c+c-a} = x^0 = 1$ Ans

Q:15: $\sqrt{\frac{x^3}{x^c}} \times \sqrt{\frac{x^c}{x^a}} \times \sqrt{\frac{x^a}{x^b}}$

Solution: $\sqrt{\frac{x^3}{x^c}} \times \sqrt{\frac{x^c}{x^a}} \times \sqrt{\frac{x^a}{x^b}} = \sqrt{\frac{x^3}{x^c} \times \frac{x^c}{x^a} \times \frac{x^a}{x^b}}$

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$$= \sqrt{\frac{x^{b+c+a}}{x^{c+a+b}}}$$

$$= \sqrt{x^{b+c+a-c-a-b}} = \sqrt{x^0}$$

$$= 1 \text{ Ans.}$$

Q:16: $\left(\frac{x^l}{x^m}\right)^{l+m} \cdot \left(\frac{x^m}{x^n}\right)^{m+n} \cdot \left(\frac{x^n}{x^l}\right)^{n+l}$

Sol: $\left(\frac{x^l}{x^m}\right)^{l+m} \cdot \left(\frac{x^m}{x^n}\right)^{m+n} \cdot \left(\frac{x^n}{x^l}\right)^{n+l} = (x^{l-m})^{l+m} \cdot (x^{m-n})^{m+n} \cdot (x^{n-l})^{n+l}$

$$= x^{l^2-m^2} \cdot x^{m^2-n^2} \cdot x^{n^2-l^2}$$

$$= x^{l^2-m^2+m^2-n^2+n^2-l^2} = x^0 = 1 \text{ Ans}$$

Scientific Notation: A number which can be written as a power of "10" is called scientific notation.

For example $1234 = 1.234 \times 10^3$

Method of writing a number x in scientific notation

When $x > 0$:

- (i) place decimal point after the first non zero number.
- (ii) Count the numbers between the original and new decimal point or after the decimal point .
- (iii) These numbers are write in power of 10.

Method of writing a number x in scientific notation

When $x < 0$:

- (i) Place decimal point after the first non zero number.
- (ii) Count the numbers between the original and new decimal point .which is a negative number .
- (iif) These numbers are write in power of 10.

Example 1: Write 2600 in scientific notation .

Solution : In scientific notation

$$2600 = 2.6 \times 10^3$$

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Exercise 6.3

Write in scientific notation.

Q.1: 480

Solution: $480 = 4.8 \times 10^2$

Q.2: 4576000

Solution: $4576000 = 4.576 \times 10^6$

Q.3: 0.0000652

Solution: $0.0000652 = 6.52 \times 10^{-5}$

Q.4: 0.31

Solution: $0.31 = 3.1 \times 10^{-1}$

Q.5: 0.00156

Solution: $0.00156 = 1.56 \times 10^{-3}$

Q.6: 145200

Solution: $145200 = 1.452 \times 10^5$

Q.7: 0.05×10^{-3}

Solution: $0.05 \times 10^{-3} = 5 \times 10^{-5}$

Q.8: 24.5×10^3

Solution: $24.5 \times 10^3 = 2.45 \times 10^4$

Q.9: 0.365×10^{-2}

Solution: $0.365 \times 10^{-2} = 3.65 \times 10^{-3}$

Q.10: 0.000902

Solution: $0.000902 = 9.02 \times 10^{-4}$

Write in standard notation.

Q.11: 2.56×10^8

Solution: $2.56 \times 10^8 = \frac{256}{100} \times 100000000$
 $= 256000000$

Q.12: 1.09×10^6

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Solution: $1.09 \times 10^8 = \frac{109}{100} \times 1000000$
 $= 1090000$

Q.13: 3.65×10^{-4} .

Solution : $3.65 \times 10^{-4} = \frac{365}{100} \times \frac{1}{10^4}$.
 $= \frac{365}{100} \times \frac{1}{10000} = \frac{356}{1000000}$
 $= 0.000356$

Q.14 : 10^{-7}

Solution : $10^{-7} = \frac{1}{10^7}$
 $= \frac{1}{10000000}$
 $= 0.0000001$

Q.15: 6.89×10^6

Solution: $6.89 \times 10^6 = \frac{689}{100} \times 1000000 = 689000$

Q.16: 4.73×10^0

Solution: $4.73 \times 10^0 = 4.73 \times 1 = 4.73$

Logarithms: if “a”, y and x are any real numbers and
“a”, y are positive numbers and $a \neq 1$.

Let $a^x = y$ then $\log_a y = x$.

i.e. $a^x = y \Leftrightarrow \log_a y = x$.

Example 1 : Find the value of $\log_3 27$

Solution: Let $\log_3 27 = x$

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$$\Rightarrow 3^x = 27$$

$$\Rightarrow 3^x = 3^3$$

$$\Rightarrow x = 3 \Rightarrow \log_3 27 = 3$$

Exercise 6.4

Q.1: $7^3 = 343$

Solution: $7^3 = 343 \Rightarrow \log_7 343 = 3$

Q.2: $2^{-5} = \frac{1}{32}$

Solution: $2^{-5} = \frac{1}{32} \Rightarrow \log_2 \left(\frac{1}{32}\right) = -5$

Q.3: $x^{\frac{2}{3}} = y$

Solution: $x^{\frac{2}{3}} = y \Rightarrow \log_x y = \frac{2}{3}$

Q.4: $10^0 = 1$

Solution: $10^0 = 1 \Rightarrow \log_{10} 1 = 0$

Q.5: $\left(\frac{1}{2}\right)^3 = \frac{1}{8}$

Solution: $\left(\frac{1}{2}\right)^3 = \frac{1}{8} \Rightarrow \log_{\frac{1}{2}} \left(\frac{1}{8}\right) = 3$

Q.6: $9^{\frac{1}{2}} = 3$

Solution: $9^{\frac{1}{2}} = 3 \Rightarrow \log_9 3 = \frac{1}{2}$

Write the following in exponential form .

Q.7: $\log_4 16 = 2$

Solution: $\log_4 16 = 2 \Rightarrow 4^2 = 16$

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Q.8: $\log_2 \frac{1}{64} = -6$

Solution: $\log_2 \frac{1}{64} = -6 \Rightarrow 2^{-6} = \frac{1}{64}$

Q.9: $\log_a m = 5$

Solution: $\log_a m = 5 \Rightarrow a^5 = m$

Q.10: $\log_{12} 144 = 2$

Solution: $\log_{12} 144 = 2 \Rightarrow 12^2 = 144$

Q.11: $\log_a a = 1$

Solution: $\log_a a = 1 \Rightarrow a^1 = a$

Q.12: $\log_a 1 = 0$

Solution: $\log_a 1 = 0 \Rightarrow a^0 = 1$

Find the values of x:

Q.13: $\log_2 x = 3$

Solution: $\log_2 x = 3$ by definition of logarithm

$\Rightarrow 2^3 = x$

$\Rightarrow x = 8$

Q.14: $\log_x 0.25 = 2$

Solution: $\log_x 0.25 = 2$

$\Rightarrow x^2 = 0.25$

$\Rightarrow x = \sqrt{0.25} = 0.5$

Q.15: $\log_{81} 9 = x$

Solution: $\log_{81} 9 = x$

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$$\Rightarrow (81)^x = 9$$

$$\Rightarrow 3^{4x} = 3^2 \quad \text{comparing powers}$$

$$\Rightarrow 4x = 2$$

$$\Rightarrow x = \frac{2}{4} = \frac{1}{2}$$

Q.16: $\log_x 36 = 2$

Solution: $\log_x 36 = 2$

$$\Rightarrow x^2 = 36$$

$$\Rightarrow x^2 = 6^2 \quad \text{comparing base}$$

$$\Rightarrow x = 6$$

Q.17: $\log_9 x = -\frac{3}{2}$

Solution: $\log_9 x = -\frac{3}{2}$

$$\Rightarrow (9)^{-\frac{3}{2}} = x$$

$$\Rightarrow x = (3^2)^{-\frac{3}{2}}$$

$$\Rightarrow x = 3^{-3} = \frac{1}{3^3}$$

$$\Rightarrow x = \frac{1}{27}$$

Q.18: $\log_4 x = -3$

Solution: $\log_4 x = -3$

$$\Rightarrow 4^{-3} = x$$

$$\Rightarrow x = \frac{1}{4^3}$$

$$\Rightarrow x = \frac{1}{64}$$

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Q.19: $\log_8 x = \frac{4}{3}$

Solution: $\log_8 x = \frac{4}{3} \Rightarrow 8^{\frac{4}{3}} = x$

$$\Rightarrow x = (2^3)^{\frac{4}{3}}$$

$$\Rightarrow x = 2^4 \Rightarrow x = 16$$

Q.20: $\log_x 625 = 4$

Solution: $\log_x 625 = 4$

$$\Rightarrow x^4 = 625 \Rightarrow x^4 = 5^4$$

$$\Rightarrow x = 5$$

Common logarithm : A Logarithm having base 10 is called common logarithms or Briggs logarithms. The base of this logarithms is not written because it is to be considered.

For example $\log_{10} x$ is written as $\log x$.

Characteristic and Mantissa: Logarithm of a number

Consists two parts .one is integer is called characteristic .it may be positive or negative .

The second part is decimal fraction is called mantissa. It is always positive.

Rules of Characteristic:

(i) If the number $x > 1$ then characteristic of $\log x$ is one less than the numbers of digits on the left of decimal point which is zero or positive .

(ii) If the number $x < 1$ then characteristic of $\log x$ is one greater than the numbers of zeros after the decimal point which is negative .It is denoted by $-\bar{a}$ or \bar{a}

Example: Find the value of $\log 3958$

Solution: Here characteristic = 3

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Now we find Mantissa

We see 39 in column 5 in logarithm table which is 5966 and now see in difference column 8 which is 9. Now add 9 to 5966 which is
 $5966 + 9 = 5975$.

Hence Mantissa of $\log 3958 = 0.5975$

Thus $\log 3958 = 3.5975$

Exercise 6.5(a)

Find logarithms of the following numbers.

Q.1: 2476

Solution: Here characteristic = 3

Now we find Mantissa

We see 24 in column 7 in logarithm table which is 3927 and now see in difference column 7 which is 11. Now add 11 to 3927 which is
 $3927 + 11 = 3938$

Hence Mantissa of $\log 2476 = 0.3938$

Thus $\log 2476 = 3.3938$

Q.2: 2.4

Solution : Here characteristic = 0

Now we find Mantissa

We see 24 in column 0 in logarithm table which is 3802.

Hence Mantissa = 0.3802

Thus $\log 2.4 = 0.3802$

Q.3: 92.5

Solution: Here characteristic = 1

Now we find Mantissa

We see 92 in column 5 in logarithm table which is 9661.

Hence Mantissa = 0.9661

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Thus $\log 92.5 = 1.9661$.

Q.4: 482.7

Solution: Here characteristic = 2

Now we find Mantissa

We see 48 in column 2 in logarithm table which is 6830 and now see in difference column 7 which is 6. Now add 6 to 6830 which is

$$6830 + 6 = 6836$$

Hence Mantissa = 0.6836

$$\text{Thus } \log 482.7 = 2.6836$$

Q.5: 0.783

Solution: Here characteristic = $\bar{1}$

Now we find Mantissa

We see 78 in column 3 in logarithm table which is 8960.

Hence Mantissa = 0.8960

$$\text{Thus } \log 0.783 = \bar{1}.8960$$

Q.6: 0.09566

Solution: Here characteristic = $\bar{2}$

Now we find Mantissa

We see 95 in column 6 in logarithm table which is 9805 and now see in difference column 6 which is 3. Now add 3 to 9805 which is

$$9805 + 3 = 9808$$

Hence Mantissa = 0.9808

$$\text{Thus } \log 0.09566 = \bar{2}.9808$$

Q.7: 0.006735

Solution: Here characteristic = $\bar{3}$

Now we find Mantissa

We see 67 in column 3 in logarithm table which

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is 8280 and now see in difference column 5 which is 3 .Now add 3 to 8280 which is

$$8280 + 3 = 8283$$

Hence Mantissa = 0.8283

$$\text{Thus } \log 0.006735 = \bar{3}.8283$$

Q.8: 0.000455

Solution: Here characteristic = $\bar{4}$

Now we find Mantissa

We see 45 in column 5 in logarithm table which is 6580.

Hence Mantissa = 0.6580

$$\text{Thus } \log 0.000455 = \bar{4}.6580$$

Q.9: 700

Solution: Here characteristic = 2

Now we find Mantissa

We see 70 in column 0 in logarithm table which is 8451.

Hence Mantissa = 0.8451

$$\text{Thus } \log 700 = 2.8451$$

Q.10: 39580

Solution: Here characteristic = 4

Now we find Mantissa

We see 39 in column 5 in logarithm table which is 5966 and now see in difference column 8 which is 9 .Now add 9 to 5966 which is

$$5966 + 9 = 5975$$

Hence Mantissa = 0.5975

$$\text{Thus } \log 39580 = 4.5975$$

Anti logarithm : if $\log y = x$ and we find the value of y we take anti logarithm i.e. $y = \text{anti log } x$

For this we use anti logarithm table .In this case

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the characteristic only decided the position of decimal .

Example: find x when $\log x = 2.4983$

Solution: Here characteristic = 2

And Mantissa = 0.4983

To find the value of x we use antilogarithm table

We see 0.49 in column 8 in antilogarithm table which is 3148 and now see in difference column 3 which is 2 .Now add 2 to 3148 which is 3150
Since characteristic is 2 then place decimal after three digits .

Thus $\text{Antilog}(\log x) = \text{Antilog}(2.4983)$

$\Rightarrow x = 315.0$

Exercise.6.5(b)

Find anti -logarithms of the following numbers.

Q.1: 1.2508

Solution: Here characteristic = 1

And Mantissa = 0.2508

To find anti logarithm we use antilogarithm table

We see 0.25 in column 0 in antilogarithm table which is 1778.

And now see in difference column 8 which is 3

Now add 3 to 1778 which is 1781.

Since characteristic is 1 then place decimal after two digits .

Thus $\text{Antilog}(1.2508) = 17.81$

Q.2: 0.8401

Solution: Here characteristic = 0

And Mantissa = 0.8401

To find anti logarithm we use antilogarithm table.

We see 0.84 in column 0 in antilogarithm table which is 6918.

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- And now see in difference column 1 which is 2
- Now add 2 to 6918 which is 6920.
- Since characteristic is 0 then place decimal after one digits .
- Thus $\text{Antilog}(0.8401) = 6.920$

Q.3: 2.540

Solution: Here characteristic = 2

And Mantissa = 0.540

To find anti logarithm we use antilogarithm table.
We see 0.54 in column 0 in antilogarithm table which is 3467.

Since characteristic is 2 then place decimal after three digits .

Thus $\text{Antilog}(2.540) = 346.7$

Q 4 : $\bar{2}.2508$

Solution: Here characteristic = $\bar{2}$

And Mantissa = 0.2508

To find anti logarithm we use antilogarithm table
We see 0.25 in column 0 in antilogarithm table which is 1778.

And now see in difference column 8 which is 3
Now add 3 to 1778 which is 1781.
Since characteristic is $\bar{2}$ then place decimal point before one zero.

Thus $\text{Antilog}(\bar{2}.2508) = 0.01778$

Q 5 : $\bar{1}.5463$

Solution: Here characteristic = $\bar{1}$

And Mantissa = 0.5463

To find anti logarithm we use antilogarithm table
We see 0.54 in column 6 in antilogarithm table which is 3516.

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And now see in difference column 3 which is 2

Now add 2 to 3516 which is 3518.

Since characteristic is $\bar{1}$ then place decimal before digits .

$$\text{Thus } \text{Antilog}(\bar{1}.5463) = 0.3518$$

Q.6: 3.5526

Solution: Here characteristic = 3

And Mantissa = 0.5526

To find anti logarithm we use antilogarithm table

We see 0.55 in column 2 in antilogarithm table which is 3565.

And now see in difference column 6 which is 5

Now add 5 to 3565 which is 3570.

Since characteristic is 3 then place decimal after four digits .

$$\text{Thus } \text{Antilog}(3.5526) = 3570.0$$

Find the values of x from the following equations.

Q.7: $\log x = \bar{1}.8401$

Solution: Here characteristic = $\bar{1}$

And Mantissa = 0.8401

To find anti logarithm we use antilogarithm table.

We see 0.84 in column 0 in antilogarithm table which is 6918.

And now see in difference column 1 which is 2

Now add 2 to 6918 which is 6920.

Since characteristic is $\bar{1}$ then place decimal before digits .

$$\text{Thus } \text{Antilog}(\log x) = \text{Antilog}(\bar{1}.8401)$$

$$\Rightarrow x = 0.6920$$

Q.8: $\log x = 2.1931$

Solution: Here characteristic = 2

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And Mantissa = 0.1931

To find anti logarithm we use antilogarithm table

We see 0.19 in column 3 in antilogarithm table which is 1560.

And now see in difference column 1 which is 0

Now add 0 to 1560 which is 1560.

Since characteristic is 2 then place decimal after three digits .

Thus $\text{Antilog}(\log x) = \text{Antilog}(2.1931)$

$$\Rightarrow x = 156.0$$

Q.9: $\log x = 4.5911$

Solution: Here characteristic = 4

And Mantissa = 0.5911

To find anti logarithm we use antilogarithm table

We see 0.59 in column 1 in antilogarithm table which is 3899.

And now see in difference column 1 which is 1

Now add 1 to 3899 which is 3900.

Since characteristic is 4 then place decimal after four digits .

Thus $\text{Antilog}(\log x) = \text{Antilog}(4.5911)$

$$\Rightarrow x = 39000.0$$

Q.10: $\log x = \bar{3}.0253$

Solution: Here characteristic = $\bar{3}$

And Mantissa = 0.0253

To find anti logarithm we use antilogarithm table

We see 0.02 in column 5 in antilogarithm table which is 1059.

And now see in difference column 3 which is 1

Now add 1 to 1059 which is 1060.

Since characteristic is $\bar{3}$ then place decimal point

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before two zeros.

$$\text{Thus } \text{Antilog}(\log x) = \text{Antilog}(\bar{3}.0253) \\ \Rightarrow x = 0.001060$$

Q.11: $\log x = 1.8716$

Solution: Here characteristic = 1

And Mantissa = 0.8716

To find anti logarithm we use antilogarithm table

We see 0.87 in column 1 in antilogarithm table which is 7430.

And now see in difference column 6 which is 10

Now add 10 to 7430 which is 7440.

Since characteristic is 1 then place decimal after two digits.

$$\text{Thus } \text{Antilog}(\log x) = \text{Antilog}(1.8716) \\ \Rightarrow x = 74.40$$

Q.12: $\log x = \bar{2}.8370$

Solution: Here characteristic = $\bar{2}$

And Mantissa = 0.8370

To find anti logarithm we use antilogarithm table

We see 0.83 in column 7 in antilogarithm table which is 6871.

Since characteristic is $\bar{2}$ then place decimal point before one zero.

$$\text{Thus } \text{Antilog}(\log x) = \text{Antilog}(\bar{2}.8370) \\ \Rightarrow x = 0.06871$$

Laws of logarithm:

$$(i) \log_a mn = \log_a m + \log_a n$$

Proof: Suppose $\log_a m = x$ and $\log_a n = y$

$$\text{Then } a^x = m \text{ and } a^y = n$$

$$\text{Now } mn = a^x \cdot a^y$$

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$$\Rightarrow mn = a^{x+y} \text{ or } a^{x+y} = mn$$

$$\Rightarrow \log_a mn = x + y \text{ (use definition of log)}$$

Put values of x and y

$$\Rightarrow \log_a mn = \log_a m + \log_a n \quad \text{Proved}$$

$$(ii) \log_a \frac{m}{n} = \log_a m - \log_a n$$

Proof: Suppose $\log_a m = x$, $\Rightarrow a^x = m$

$$\text{And } \log_a n = y \Rightarrow a^y = n,$$

$$\text{Then } \frac{m}{n} = \frac{a^x}{a^y} \Rightarrow \frac{m}{n} = a^{x-y}$$

$$\Rightarrow a^{x-y} = \frac{m}{n} \Rightarrow \log_a \left(\frac{m}{n} \right) = x - y$$

Put values of x and y

$$\Rightarrow \log_a \frac{m}{n} = \log_a m - \log_a n$$

$$(iii) \log_a m^n = n \log_a m$$

Proof: Suppose $\log_a m = x$

$$\Rightarrow a^x = m \Rightarrow (a^x)^n = m^n$$

$$\Rightarrow a^{xn} = m^n \text{ (use definition of log)}$$

$$\Rightarrow \log_a m^n = nx$$

$$\Rightarrow \log_a m^n = n \log_a m \quad \text{Proved.}$$

$$(iv) \log_a m = \log_b m \times \log_a b$$

Proof: Let $b^x = m$

$$\Rightarrow \log_b m = x$$

$$\text{now } \log_a m = \log_a b^x \quad (\text{Put } m = b^x)$$

$$\Rightarrow \log_a m = x \log_a b \quad (\text{use law iii})$$

$$\text{put values of } x = \log_b m$$

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$$\Rightarrow \log_a m = \log_b m \times \log_a b$$

Exercise 6.6

Write the following expressions using the laws of log.

Q.1: $\log(2.56)(3.4)$

Solution: $\log(2.56)(3.4) = \log(2.56) + \log(3.4)$

Q.2: $\log\left(\frac{3.56}{41.2}\right)$

Solution: $\log\left(\frac{3.56}{41.2}\right) = \log(3.56) - \log(41.2)$

Q.3: $\log \sqrt{5}$

Solution: $\log \sqrt{5} = \log(5)^{\frac{1}{2}}$
 $= \frac{1}{2} \log 5$

Q.4: $\log(38.5)^7$

Solution: $\log(38.5)^7 = 7 \log(38.5)$

Q.5: $\log \frac{1}{(0.0035)^{-4}}$

Solution: $\log \frac{1}{(0.0035)^{-4}} = \log 1 - \log(0.0035)^{-1}$

As $\log 1 = 0$

Then $\log \frac{1}{(0.0035)^{-4}} = 0 - (-1) \log(0.0035)$
 $= \log(0.0035)$

Q.6: $\log(45)$

Solution: $\log(45) = \log(9 \times 5)$

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$$\Rightarrow \log(45) = \log 9 + \log 5$$

$$= \log 3^2 + \log 5$$

$$= 2\log 3 + \log 5$$

Write the following in single logarithm

Q.7: $\log a + \log b - \log c$

Solution: $\log a + \log b - \log c = \log(ab) - \log c$
 $= \log \frac{ab}{c}$

Q.8: $\log \sqrt{7} - \log \sqrt{5}$

Solution: $\log \sqrt{7} - \log \sqrt{5} = \log \left(\frac{\sqrt{7}}{\sqrt{5}} \right)$
 $= \log \left(\frac{7}{5} \right)^{\frac{1}{2}}$
 $= \frac{1}{2} \log \left(\frac{7}{5} \right)$

Q.9: $3\log a - \log a^2 b + 5\log b$

Solution:

$$\begin{aligned} 3\log a - \log a^2 b + 5\log b &= \log a^3 - \log a^2 b + \log b^5 \\ &= \log a^3 + \log b^5 - \log a^2 b \\ &= \log(a^3 b^5) - \log(a^2 b) \\ &= \log \left(\frac{a^3 b^5}{a^2 b} \right) \\ &= \log(ab^4) \text{ Ans.} \end{aligned}$$

Q.10: $\log_3 5 \log_5 8$

Solution: As we know that from the fourth law of Logarithm is $\log_a m \log_m n = \log_a n$

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Then $\log_3 5 \log_5 8 = \log_3 8$

Find the value of "a" from the following equations.

Q.11: $\log_2 6 + \log_2 7 = \log_2 a$

Solution: As $\log_2 6 + \log_2 7 = \log_2 a$

$\Rightarrow \log_2 (6 \times 7) = \log_2 a$

$\Rightarrow \log_2 42 = \log_2 a$ Taking anti log

$\Rightarrow \text{Anti log}(\log_2 42) = \text{Anti log}(\log_2 a)$

$\Rightarrow 2^{42} = 2^a$ comparing powers

$\Rightarrow a = 42$

Q.12: $\log_{\sqrt{3}} a = \log_{\sqrt{3}} 5 + \log_{\sqrt{3}} 8 - \log_{\sqrt{3}} 2$

Solution: $\log_{\sqrt{3}} a = \log_{\sqrt{3}} 5 + \log_{\sqrt{3}} 8 - \log_{\sqrt{3}} 2$

$\Rightarrow \log_{\sqrt{3}} a = \log_{\sqrt{3}} (5 \times 8) - \log_{\sqrt{3}} 2$

$\Rightarrow \log_{\sqrt{3}} a = \log_{\sqrt{3}} \left(\frac{40}{2}\right) = \log_{\sqrt{3}} (20)$

$\Rightarrow \text{Anti log}(\log_{\sqrt{3}} a) = \text{Anti log}(\log_{\sqrt{3}} (20))$

$\Rightarrow a = 20$

Q.13: $\log_6 25 - \log_6 5 = \log_6 a$

Solution: $\log_6 25 - \log_6 5 = \log_6 a$

$\Rightarrow \log_6 \left(\frac{25}{5}\right) = \log_6 a$

$\Rightarrow \log_6 5 = \log_6 a$

$\Rightarrow \text{Anti log}(\log_6 5) = \text{Anti log}(\log_6 a)$

$\Rightarrow 5 = a$

$\Rightarrow a = 5$

Example1: Simplify with the help of logarithm.
 $(238.2)(9.506)$

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Solution: Let $x = (238.2)(9.506)$ Taking log

$$\begin{aligned}\log x &= \log(238.2)(9.506) \\ &= \log(238.2) + \log(9.506)\end{aligned}$$

$$\Rightarrow \log x = 2.3770 + 0.9780 \quad \text{use log table}$$

$$\Rightarrow \log x = 3.3550$$

$$\text{Anti log}(\log x) = \text{Anti log}(3.3550)$$

$$\Rightarrow x = 2265.0$$

Exercise 6.7

Simplify with the help of logarithm.

Q.1: $(32.4)(63.78)$

Solution: let $x = (32.4)(63.78)$ Taking log

$$\begin{aligned}\log x &= \log(32.4)(63.78) && \text{use laws of log} \\ &= \log(32.4) + \log(63.78)\end{aligned}$$

$$\Rightarrow \log x = 1.5105 + 1.8048$$

$$\Rightarrow \log x = 3.3153$$

Here characteristic = 3

And Mantissa = 0.3153

Then we take antilog

We see 0.31 in 5 column of antilogarithm table which is 2065 and see in difference column 3

which is 1. Now add these which 2066. Then

$$\text{Anti log}(\log x) = \text{Anti log}(3.3153)$$

$$\Rightarrow x = 2066$$

Q.2: $(6.237)^3$

Solution: Let $x = (6.237)^3$ Taking log

$$\Rightarrow \log x = \log(6.237)^3 \quad \text{Use law of log}$$

$$\Rightarrow \log x = 3 \log(6.237)$$

use log table

$$\Rightarrow \log x = 3(0.7950) = 2.3850$$

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Here characteristic = 0

Mantissa = 0.3850

Then use antilog of both sides .

We see 0.38 in 5 column of antilogarithm table which is 2427 . Then

$$\text{Anti log}(\log x) = \text{Anti log}(0.3850)$$

$$\Rightarrow x = 242.7$$

Q.3: $\sqrt[3]{0.04106}$

Solution: Let $x = \sqrt[3]{0.04106}$ Taking log

$$\Rightarrow \log x = \log(0.04106)^{\frac{1}{3}} \quad \text{Use law of log}$$

$$\Rightarrow \log x = \frac{1}{3} \log(0.04106)$$

use log table

$$\Rightarrow \log x = \frac{1}{3} (\bar{2}.6134) = \frac{1}{3} (-2 + 0.6134)$$

$$= \frac{1}{3} (-1.3866) = -0.4622$$

$$\Rightarrow \log x = -1 + 1 - 0.4622$$

$$= -1 + 0.5378$$

$$\Rightarrow \log x = \bar{1}.5378$$

Here characteristic = $\bar{1}$

And Mantissa = 0.5378

Then we take antilog

We see 0.53 in 7 column of antilogarithm table which is 3443 and see in difference column 8 which is 6 Now add these which 3449 . Then

$$\text{Anti log}(\log x) = \text{Anti log}(\bar{1}.5378)$$

$$\Rightarrow x = 0.3449$$

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Q.4: $\frac{(67.35)(48.27)}{(16.18)^2}$

Solution: Let $x = \frac{(67.35)(48.27)}{(16.18)^2}$ Take log

$$\log x = \log \frac{(67.35)(48.27)}{(16.18)^2} \text{ use laws of log}$$

$$\Rightarrow \log x = \log 67.35 + \log(48.27) - \log(16.18)^2$$

$$\Rightarrow \log x = \log 67.35 + \log(48.27) - 2\log(16.18)$$

Use log table

$$\Rightarrow \log x = 1.8283 + 1.6837 - 2(1.2090)$$

$$\Rightarrow \log x = 3.512 - 2.414$$

$$\Rightarrow \log x = 1.094$$

Here characteristic = 1

$$\text{Mantissa} = 0.094$$

Then take antilog of both sides.

We see 0.09 in 4 column of antilogarithm table which is 1242 . Then

$$\text{Anti log}(\log x) = \text{Anti log}(1.094)$$

$$\Rightarrow x = 12.42$$

Q.5: $\frac{(542)\sqrt[3]{383}}{32.72}$

Solution: Let $x = \frac{(542)\sqrt[3]{383}}{32.72}$ Taking log of both sides

$$\log x = \log \frac{(542)\sqrt[3]{383}}{32.72} \text{ use laws of log}$$

$$\Rightarrow \log x = \log(542) + \log(383)^{\frac{1}{3}} - \log(32.72) \text{ use log table}$$

$$\Rightarrow \log x = 2.7340 + \frac{1}{3}\log(383) - 1.5148$$

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$$\Rightarrow \log x = 2.7340 + \frac{1}{3}(2.5832) - 1.5148$$

$$\Rightarrow \log x = 2.7340 + 0.8611 - 1.5148$$

$$\Rightarrow \log x = 2.0803$$

Here characteristic = 2

Mantissa = 0.0803

Then use antilog of both sides .

We see 0.08 in 0 column of antilogarithm table which is 1202 and see in difference column 3 which is 1 .Now add these which 1203 . Then

$$\text{Anti log}(\log x) = \text{Anti log}(2.0803)$$

$$\Rightarrow x = 120.3 \text{ Ans (Note Book answer is wrong).}$$

Q.4:
$$\frac{0.003634}{(47.00)(0.0980)}$$

Solution: Let $x = \frac{0.003634}{(47.00)(0.0980)}$ Taking log

$$\log x = \log \frac{0.003634}{(47.00)(0.0980)} \text{ use laws of log}$$

$$\Rightarrow \log x = \log(0.003634) - \log(47.00) - \log(0.0980)$$

Use log table

$$\Rightarrow \log x = \bar{3}.5604 - 1.6721 - \bar{2}.9912$$

$$\Rightarrow \log x = -3 + 0.5604 - 1 - 0.6721 - (-2 + 0.9912)$$

$$\Rightarrow \log x = -3 + 0.5604 - 1 - 0.6721 + 2 - 0.9912$$

$$\Rightarrow \log x = -3.1029$$

Add and subtract 4 to make the number positive.

$$\Rightarrow \log x = -4 + 4 - 3.1029$$

$$\Rightarrow \log x = -4 + 0.8971$$

$$\Rightarrow \log x = \bar{4}.8971$$

Here characteristic = $\bar{4}$

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Mantissa = 0.8971

Then take antilog of both sides .

We see 0.89 in 7 column of antilogarithm table which is 7889 and see in difference column 1 which is 2 .Now add these which 7891 . Then

$$\text{Antilog}(\log x) = \text{Antilog}(4.8971)$$

$$\Rightarrow x = 0.0007891$$

Q.5: $\frac{(84.5)^{\frac{1}{3}} \sqrt{39.7}}{23.4}$

Solution: Let $x = \frac{(84.5)^{\frac{1}{3}} \sqrt{39.7}}{23.4}$ Take log of both sides

$$\log x = \log \frac{(84.5)^{\frac{1}{3}} \sqrt{39.7}}{23.4} \quad \text{use laws of log}$$

$$\Rightarrow \log x = \log(84.5)^{\frac{1}{3}} + \log \sqrt{39.7} - \log 23.4$$

$$= \frac{1}{3} \log(84.5) + \log(39.7)^{\frac{1}{2}} - \log(23.4)$$

$$= \frac{1}{3} \log(84.5) + \frac{1}{2} \log(39.7) - \log(23.4)$$

Use log table

$$\begin{aligned} \Rightarrow \log x &= \frac{1}{3}(1.9269) + \frac{1}{2}(1.5988) - 1.3692 \\ &= 0.6423 + 0.7994 - 1.3692 \end{aligned}$$

$$\Rightarrow \log x = 0.0725$$

Here characteristic = 0

Mantissa = 0.0725

Then take antilog of both sides .

We see 0.07 in 2 column of antilogarithm table

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which is 1180 and see in difference column 5

which is 1. Now add these which 1181. Then

$$\text{Anti log}(\log x) = \text{Anti log}(0.0725)$$

$$\Rightarrow x = 1.181$$

Q.6: $\frac{(23.60)(8.719)^3}{(4850)^2}$

Solution: Let $x = \frac{(23.60)(8.719)^3}{(4850)^2}$ Take log

$$\log x = \log \left(\frac{(23.60)(8.719)^3}{(4850)^2} \right) \text{ use laws of log}$$

$$\Rightarrow \log x = \log 23.60 + \log(8.719)^3 - \log(4850)^2$$

$$\Rightarrow \log x = \log 23.60 + 3 \log(8.719) - 2 \log(4850)$$

Use log table

$$\Rightarrow \log x = 1.3729 + 3(0.9404) - 2(3.6857)$$

$$\Rightarrow \log x = 1.3729 + 2.8212 - 7.3714$$

$$\Rightarrow \log x = -3.1773$$

Adding and subtract 4 ,

$$\Rightarrow \log x = -4 + 4 - 3.1773$$

$$= -4 + 0.8227$$

$$\Rightarrow \log x = \bar{4}.8227$$

Here characteristic = $\bar{4}$

Mantissa = 0.8227

Then take antilog of both sides .

We see 0.82 in 2 column of antilogarithm table

which is 6637 and see in difference column 7

which is 11. Now add these which 6648. Then

$$\text{Anti log}(\log x) = \text{Anti log}(\bar{4}.8227)$$

$$\Rightarrow x = 0.0006648$$

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Q.7: $\frac{(86.2)^2(37.37)}{591}$

Solution: Let $x = \frac{(86.2)^2(37.37)}{591}$ Take log

$$\log x = \log\left(\frac{(86.2)^2(37.37)}{591}\right) \text{ use laws of log}$$

$$\Rightarrow \log x = \log(86.2)^2 + \log(37.37) - \log(591)$$

$$\Rightarrow \log x = 2\log(86.2) + \log(37.37) - \log(591)$$

Use log table

$$\Rightarrow \log x = 2(1.9355) + (1.5725) - (2.7716)$$

$$\Rightarrow \log x = 3.871 + 1.5725 - 2.7716$$

$$\Rightarrow \log x = 2.6719$$

Here characteristic = 2

$$\text{Mantissa} = 0.6719$$

Then take antilog of both sides .

We see 0.67 in 1 column of antilogarithm table

which is 4688 and see in difference column 9

which is 10 .Now add these which 4698 . Then

$$\text{Anti log}(\log x) = \text{Anti log}(2.6719)$$

$$\Rightarrow x = 469.8$$

If $\log 2 = 0.3010$, $\log 3 = 0.4771$ and $\log 7 = 0.8450$,

Find the value of the following logarithm without Consulting logarithm table.

Q.8: $\log 6$

Solution: $\log 6 = \log(2 \times 3)$ By law of log

$$\Rightarrow \log 6 = \log 2 + \log 3 \quad \text{put values}$$

$$\Rightarrow \log 6 = 0.3010 + 0.4771$$

$$\Rightarrow \log 6 = 0.7781$$

Q.9: $\log 21$

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Solution: $\log 21 = \log(3 \times 7)$ by law of log

$$\Rightarrow \log 21 = \log 3 + \log 7 \quad \text{put values}$$

$$= 0.4771 + 0.8450$$

$$= 1.3221$$

Q.10: $\log 42$

Solution: As $\log 42 = \log(2 \times 3 \times 7)$ by law of log

$$\Rightarrow \log 42 = \log 2 + \log 3 + \log 7 \quad \text{put values}$$

$$= 0.3010 + 0.4771 + 0.8450$$

$$\Rightarrow \log 42 = 1.6231$$

Q.11: $\log \frac{49}{6}$

Solution: $\log \frac{49}{6} = \log 49 - \log 6$ by law of log

$$\Rightarrow \log \frac{49}{6} = \log 7^2 - \log(2 \times 3)$$

$$= 2 \log 7 - (\log 2 + \log 3) \quad \text{put values}$$

$$= 2(0.8450) - (0.3010 + 0.4771)$$

$$\Rightarrow \log \frac{49}{6} = 0.9119$$

Q.12: $\log 0.072$

Solution: $\log 0.072 = \log \left(\frac{72}{1000} \right)$

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$$\Rightarrow \log 0.072 = \log 72 - \log 1000$$

$$\begin{aligned}\Rightarrow \log 0.072 &= \log(9 \times 8) - \log 10^3 \\ &= \log 9 + \log 8 - 3\log 10 \\ &= \log 3^2 + \log 2^3 - 3\log 10 \quad \text{As } \log 10 = 1\end{aligned}$$

$$\begin{aligned}\Rightarrow \log 0.072 &= 2\log 3 + 3\log 2 - 3(1) \\ &= 2(0.4771) + 3(0.3010) - 3 \\ &= -1.1428\end{aligned}$$

Exercise 6.8 (Objective type questions)

Q.1: True and false questions.

Read the following sentences carefully and encircle "T" in case of true and "F" in case of false statement.

(i) In $\sqrt[3]{8}$ radicand is 3 T – F

(ii) In $\sqrt{36}$ radical is 2 T – F

(iii) \sqrt{ab} is exponential form of an expression T – F

(iv) $\left(\frac{a}{b^3}\right)^2 = \frac{a^2}{b^6}$ T – F

(v) 0.025 can be written in scientific notation as 2.5×10^3 T – F

(vi) Logarithm was invented by Al – Musa T – F

(vii) Integral part in the logarithm of a number is called its characteristic. T – F

(viii) Mantissa in the logarithm of a number is always negative. T – F

(ix) $\log_a x = y \Leftrightarrow a^y = x$ T – F

Answers: (i) F (ii) T (iii) F (iv) T

(v) F (vi) F (vii) T (viii) F (ix) T

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Q.2: Fill in the blanks.

- (i) $\sqrt[3]{64} = \dots\dots\dots$
- (ii) $3^{-3} = \dots\dots\dots$
- (iii) Logarithm having base 10 is called
- (iv) Fractional part of logarithm is called
- (v) $\log 1 = \dots\dots\dots$
- (vi) $\log_a \frac{m}{n} = \dots\dots\dots$
- (vii) In scientific notation $0.0000346 = \dots\dots\dots$
- (viii) Logarithmic form of $6^{-2} = \frac{1}{36}$ is =
- (ix) Exponential form of $\log_2 8 = 3$ is

Answers: (i) 4 (ii) $\frac{1}{27}$ (iii) Common logarithm

(iv) Mantissa (v) 0 (vi) $\log_a m - \log_a n$

(vii) 3.46×10^{-5} (viii) $\log_6 \left(\frac{1}{36} \right) = -2$

(ix) $2^3 = 8$

Q.3: Four suggested answers are given for each question. Select the correct answer and write the corresponding letter a, b, c or d in the box.

(i) $\sqrt[3]{125} = \dots\dots\dots$

- (a) 25 (b) 5 (c) $\frac{1}{5}$ (d) 125

(ii) $-6(2)^{-3} = \dots\dots\dots$

(iii) If $\log x = 2$ then $x = \dots\dots\dots$

- (a) 200 (b) 1000 (c) 100 (d) $\frac{2}{10}$

(iv) Base in common logarithm is

- (a) e (b) π (c) 10 (d) 5

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(v) 0.000214 *can be written in scientific notation as*

- (a) 21.4×10^{-3} (b) 2.14×10^{-4} (c) 0.214×10^{-4}
(d) 0.0214×10^{-3}

(vi) $\log_6 x = 3$. *then* $x =$

- (a) 36 (b) 84 (c) 216 (d) 221

(vii) *Characteristic of* $\log 23.557$ *is*

- (a) 3 (b) 0 (c) 2 (d) 1

(viii) *Characteristic* $\log 0.0000209$ *is*

- (a) -4 (b) 5 (c) -5 (d) 4

(ix) $3^5 = 243$ *can be written in logarithm form as*

- (a) $\log_3 5 = 243$ (b) $\log_3 243 = 5$
(c) $\log_3 243 = 3$ (d) $\log_3 3 = 243$

(x) *If* $\log_{64} x = -\frac{5}{6}$ *then* $x =$

- (a) $\frac{1}{32}$ (b) $-\frac{1}{32}$ (c) 32 (d) -32

Answers: (i) b (ii) d (iii) c (iv) c (v) b (vi) c
(vii) d (viii) c (ix) b (x) a

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UNIT – 7 :

Arithmetic , Geometric Sequences .

Sequence: The arrangement of numbers in definite order under certain rule is called sequence or progression .

General term : If $a_1, a_2, a_3, \dots, a_n, \dots$ is a sequence

Then a_n is called general term of the sequence ,

Where $n = 1, 2, 3, 4, \dots$

Finite sequence : If a sequence has finite number of terms, the sequence is called finite sequence.

In finite sequence : If a sequence has infinite number of terms, the sequence is called infinite sequence.

Exercise 7.1:

Write down the first four terms of each sequence whose general terms are given below :

Q.1: $\frac{n-1}{n+1}$

Solution: Let $a_n = \frac{n-1}{n+1} \dots (i)$

Put $n = 1$ in (i) $\Rightarrow a_1 = \frac{1-1}{1+1} = \frac{0}{2} = 0$

Put $n = 2$ in (i) $\Rightarrow a_2 = \frac{2-1}{2+1} = \frac{1}{3}$

Put $n = 3$ in (i) $\Rightarrow a_3 = \frac{3-1}{3+1} = \frac{2}{4} = \frac{1}{2}$

Put $n = 4$ in (i) $\Rightarrow a_4 = \frac{4-1}{4+1} = \frac{3}{5}$

Thus first four terms are $0, \frac{1}{3}, \frac{1}{2}, \frac{3}{5}$

Q.2: $\frac{1}{4n+1}$

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Solution: Let $a_n = \frac{1}{4n+1}$ (i)

Put $n = 1$ in (i) $\Rightarrow a_1 = \frac{1}{4(1)+1} = \frac{1}{5}$

Put $n = 2$ in (i) $\Rightarrow a_2 = \frac{1}{4(2)+1} = \frac{1}{9}$

Put $n = 3$ in (i) $\Rightarrow a_3 = \frac{1}{4(3)+1} = \frac{1}{12+1} = \frac{1}{13}$

Put $n = 4$ in (i) $\Rightarrow a_4 = \frac{1}{4(4)+1} = \frac{1}{17}$

Thus first four terms are $\frac{1}{5}, \frac{1}{9}, \frac{1}{13}, \frac{1}{17}$

Q.3: $(-1)^n(n+1)$

Solution: Let $a_n = (-1)^n(n+1)$ (i)

Put $n = 1$ in (i) $\Rightarrow a_1 = (-1)^1(1+1) = -2$

Put $n = 2$ in (i) $\Rightarrow a_2 = (-1)^2(2+1) = 3$

Put $n = 3$ in (i) $\Rightarrow a_3 = (-1)^3(3+1) = -4$

Put $n = 4$ in (i) $\Rightarrow a_4 = (-1)^4(4+1) = 5$

Thus first four terms are $-2, 3, -4, 5$

Q.4: $3+4(n-1)$

Solution: Let $a_n = 3+4(n-1)$ (i)

Put $n = 1$ in (i) $\Rightarrow a_1 = 3+4(1-1) = 3+4(0) = 3$

Put $n = 2$ in (i) $\Rightarrow a_2 = 3+4(2-1) = 3+4(1) = 3+4 = 7$

Put $n = 3$ in (i) $\Rightarrow a_3 = 3+4(3-1) = 3+4(2) = 3+8 = 11$

Put $n = 4$ in (i) $\Rightarrow a_4 = 3+4(4-1) = 3+4(3) = 3+12 = 15$

Thus first four terms are $3, 7, 11, 15$

Q.5: n^2

Solution: Let $a_n = n^2$ (i)

Put $n = 1$ in (i) $\Rightarrow a_1 = (1)^2 = 1$

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Put $n = 2$ in (i) $\Rightarrow a_2 = (2)^2 = 4$

Put $n = 3$ in (i) $\Rightarrow a_3 = (3)^2 = 9$

Put $n = 4$ in (i) $\Rightarrow a_4 = (4)^2 = 16$

Thus first four terms are 1, 4, 9, 16

Q.6: $2n$

Solution: Let $a_n = 2n \dots\dots(i)$

Put $n = 1$ in (i) $\Rightarrow a_1 = 2(1) = 2$

Put $n = 2$ in (i) $\Rightarrow a_2 = 2(2) = 4$

Put $n = 3$ in (i) $\Rightarrow a_3 = 2(3) = 6$

Put $n = 4$ in (i) $\Rightarrow a_4 = 2(4) = 8$

Thus first four terms are 2, 4, 6, 8

Q.7: $\frac{(-1)^n(n-3)}{n}$

Solution: Let $a_n = \frac{(-1)^n(n-3)}{n} \dots\dots(i)$

Put $n = 1$ in (i) $\Rightarrow a_1 = \frac{(-1)^1(1-3)}{1} = \frac{-(-2)}{1} = 2$

Put $n = 2$ in (i) $\Rightarrow a_2 = \frac{(-1)^2(2-3)}{2} = \frac{-1}{2}$

Put $n = 3$ in (i) $\Rightarrow a_3 = \frac{(-1)^3(3-3)}{3} = \frac{0}{3} = 0$

Put $n = 4$ in (i) $\Rightarrow a_4 = \frac{(-1)^4(4-3)}{4} = \frac{1}{4}$

Thus first four terms are $2, -\frac{1}{2}, 0, \frac{1}{4}$

Q.8: ar^{n-1}

Solution: Let $a_n = ar^{n-1} \dots\dots(i)$

Put $n = 1$ in (i) $\Rightarrow a_1 = a(r)^{1-1} = ar^0 = a$

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Put $n = 2$ in (i) $\Rightarrow a_2 = ar^{2-1} = ar$

Put $n = 3$ in (i) $\Rightarrow a_3 = ar^{3-1} = ar^2$

Put $n = 4$ in (i) $\Rightarrow a_4 = ar^{4-1} = ar^3$

Thus first four terms are a, ar, ar^2, ar^3 .

Q.9: $n^2 + 1$

Solution: Let $a_n = n^2 + 1 \dots (i)$

Put $n = 1$ in (i) $\Rightarrow a_1 = (1)^2 + 1 = 2$

Put $n = 2$ in (i) $\Rightarrow a_2 = (2)^2 + 1 = 4 + 1 = 5$

Put $n = 3$ in (i) $\Rightarrow a_3 = (3)^2 + 1 = 9 + 1 = 10$

Put $n = 4$ in (i) $\Rightarrow a_4 = (4)^2 + 1 = 16 + 1 = 17$

Thus first four terms are $2, 5, 10, 17$

Q.10: $\frac{1}{n^3}$

Solution: Let $a_n = \frac{1}{n^3} \dots (i)$

Put $n = 1$ in (i) $\Rightarrow a_1 = \frac{1}{1^3} = \frac{1}{1} = 1$

Put $n = 2$ in (i) $\Rightarrow a_2 = \frac{1}{2^3} = \frac{1}{8}$

Put $n = 3$ in (i) $\Rightarrow a_3 = \frac{1}{3^3} = \frac{1}{27}$

Put $n = 4$ in (i) $\Rightarrow a_4 = \frac{1}{4^3} = \frac{1}{64}$

Thus first four terms are $1, \frac{1}{8}, \frac{1}{27}, \frac{1}{64}$

Write down the next two terms in each of the following Sequence :

Q.11: $2, 4, 6, \dots$

Solution: Next two terms are $8, 10$.

Q.12: $-1, 1, -1, \dots$

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Solution: Next two terms are 1 , - 1 .

Q.13: x, x^2, x^3, \dots

Solution: Next two terms are x^4, x^5 .

Q.14: $3^4, 3^3, 3^2, \dots$

Solution: Next two terms are $3^1, 3^0$, or 3 , 1 .

Q.15: - 4 , -4 , - 4 ,.....

Solution: Next two terms are - 4 , - 4 .

Q.16: - 2 , -1 , 0 ,

Solution: Next two terms are 1 , 2 .

Arithmetic sequence (A . P.) : A sequence in which each term is obtained from its preceding term by adding a constant (fixed) term is called Arithmetic sequence or Arithmetic progression . It is denoted by A.P.

The constant term is the common difference between any two consecutive terms. It is denoted by "d" .

General term of A.P. : If "a" is the first term and "d" is the common difference of a A . P . , then the general is given by $a_n = a + (n-1)d$.

Exercise 7.2:

Write the next two terms in each of the following A.P:

Q.1: 3 , 6 , 9 ,.....

Solution: The next two terms are 12 , 15

Q.2: -2 , 0 , 2 ,.....

Solution: The next two terms are 4 , 6 .

Q.3: $\frac{1}{2}, \frac{1}{4}, 0$

Solution: The next two terms are $-\frac{1}{4}, -\frac{1}{2}$.

Find the indicated term in each of the following A.P,S .

Q.4: a_{10} of 3 , 7 , 11 ,.....

Solution : Here $a = 3$, $d = 7 - 3 = 4$, $n = 10$

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As we know that $a_n = a + (n-1)d$ (i)

Put values in (i) .

$$a_{10} = 3 + (10-1)(4)$$

$$\Rightarrow a_{10} = 3 + 9(4) = 3 + 36 = 39.$$

Q.5: a_6 of $1, \frac{1}{2}, 0, \dots$

Solution: Here $a = 1$, $d = \frac{1}{2} - 1 = \frac{1-2}{2} = -\frac{1}{2}$, $n = 6$

As we know that $a_n = a + (n-1)d$ (i)

Put values in (i) .

$$a_6 = 1 + (6-1)\left(-\frac{1}{2}\right)$$

$$\Rightarrow a_6 = 1 - \frac{5}{2} = \frac{2-5}{2} = -\frac{3}{2}$$

In each of the following data one of a, d, n and a_n is missing .Find the missing number .

Q.6: $a = 3$, $a_n = 19$, $d = 2$

Solution: $a = 3$, $a_n = 19$, $d = 2$

As we know that $a_n = a + (n-1)d$ (i)

Put values in (i) .

$$19 = 3 + (n-1)(2)$$

$$\Rightarrow 19 = 3 + 2n - 2$$

$$\Rightarrow 19 - 3 + 2 = 2n$$

$$\Rightarrow 18 = 2n \quad \text{or} \quad 2n = 18$$

$$\Rightarrow n = \frac{18}{2} \Rightarrow n = 9$$

Q.7: $a = 2$, $n = 10$, $a_n = -12$

Solution: $a = 2$, $n = 10$, $a_n = -12$

As we know that $a_n = a + (n-1)d$ (i)

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Put values in (i) .

$$-12 = 2 + (10 - 1)d$$

$$\Rightarrow -12 = 2 + 9d$$

$$\Rightarrow -12 - 2 = 9d$$

$$\Rightarrow -14 = 9d \quad \text{or} \quad 9d = -14$$

$$\Rightarrow d = -\frac{14}{9}$$

Q.8: $a = 20$, $n = 10$, $d = -4$.

Solution: $a = 20$, $n = 10$, $d = -4$

As we know that $a_n = a + (n - 1)d$ (i)

Put values in (i) .

$$a_n = 20 + (10 - 1)(-4)$$

$$\Rightarrow a_n = 20 + 9(-4)$$

$$\Rightarrow a_n = 20 - 36 = -16$$

Q.9: $d = -2$, $a_n = -20$, $n = 16$

Solution: $d = -2$, $a_n = -20$, $n = 16$

As we know that $a_n = a + (n - 1)d$ (i)

Put values in (i) .

$$-20 = a + (16 - 1)(-2)$$

$$\Rightarrow -20 = a + (15)(-2)$$

$$\Rightarrow -20 = a - 30$$

$$\Rightarrow -20 + 30 = a \quad \text{or} \quad a = 10$$

Q.10: If general term of A.P. is $2n - 1$, then find

(a) the first term (b) the common difference .

Solution: The general term of A.P. is $2n - 1$, then

$$a_n = 2n - 1 \quad \text{..... (i)}$$

(i) put $n = 1$ in (i)

$$a_1 = 2(1) - 1 = 2 - 1 = 1$$

Thus first term $a = 1$

(ii) put $n = 2$ in (i)

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$$a_2 = 2(2) - 1 = 4 - 1 = 3$$

Then common difference $d = a_2 - a_1 = 4 - 1 = 3$

Q.11: If in an A.P. $a_1 = 43$, $a_{10} = 7$, find a_{25}

Solution: As $a_n = a_1 + (n-1)d$ (i)

Put $n = 10$, $a_1 = 43$, $a_{10} = 7$ in (i)

$$7 = 43 + (10-1)d$$

$$\Rightarrow 7 - 43 = 9d \Rightarrow -36 = 9d$$

$$\Rightarrow d = -\frac{36}{9} = -4$$

Now put $a_1 = 43$, $n = 25$, $d = -4$ in (i)

$$a_{25} = 43 + (25-1)(-4)$$

$$\Rightarrow a_{25} = 43 + 24(-4) = 43 - 96 = -53$$

Arithmetic mean between two numbers: Let "A" be the

Arithmetic Mean (A . M.) between a and b , then

$$A = \frac{a+b}{2}$$

Inserting n Arithmetic Mean between two numbers:

Let $A_1, A_2, A_3, \dots, A_n$ be n Arithmetic Mean

between two numbers a and b .

Then $a, A_1, A_2, A_3, \dots, A_n, b$ form a Arithmetic

Progression with $n+2$ terms.

Here $a_1 = a$ and $a_{n+2} = b$ from this find

common difference "d". Then

$$A_1 = a + d$$

$$A_2 = a + 2d$$

$$A_3 = a + 3d$$

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$$A_n = a + nd .$$

Exercise 7.3:

Find arithmetic mean between.

Q.1: 2 and 10

Solution: Let $a = 2$, $b = 10$. Then

$$A . M = \frac{a+b}{2} \text{ put values}$$

$$\Rightarrow A.M = \frac{2+10}{2} = \frac{12}{2} = 6$$

Q.2: -16 and 64

Solution: Let $a = -16$, $b = 64$. Then

$$A . M = \frac{a+b}{2} \text{ put values}$$

$$\Rightarrow A.M = \frac{-16+64}{2} = \frac{48}{2} = 24$$

Q.3: $2+\sqrt{5}$ and $2-\sqrt{5}$.

Solution: Let $a = 2+\sqrt{5}$, $b = 2-\sqrt{5}$. Then

$$A . M = \frac{a+b}{2} \text{ put values}$$

$$\Rightarrow A.M = \frac{2+\sqrt{5}+2-\sqrt{5}}{2} = \frac{4}{2} = 2$$

Q.4: $3x-4y$ and $5x+6y$

Solution: Let $a = 3x-4y$, $b = 5x+6y$. Then

$$A . M = \frac{a+b}{2} \text{ put values}$$

$$\begin{aligned} \Rightarrow A.M &= \frac{3x-4y+5x+6y}{2} = \frac{8x+2y}{2} = \frac{2(4x+y)}{2} \\ &= 4x+y \end{aligned}$$

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Q.5: $3\sqrt{5}$ and $9\sqrt{5}$

Solution: Let $a = 3\sqrt{5}$, $b = 9\sqrt{5}$. Then

$$A.M = \frac{a+b}{2} \text{ put values}$$

$$\Rightarrow A.M = \frac{3\sqrt{5} + 9\sqrt{5}}{2} = \frac{12\sqrt{5}}{2} = 6\sqrt{5}$$

Q.6: -4 and -200

Solution: Let $a = -4$, $b = -200$. Then

$$A.M = \frac{a+b}{2} \text{ put values}$$

$$\Rightarrow A.M = \frac{-4 - 200}{2} = -\frac{204}{2} = -102$$

Q.7: Insert two arithmetic Mean between 15 and 27.

Solution: Let A_1, A_2 be two arithmetic mean between 15 and 27. Then

15, $A_1, A_2, 27$ is A.P.

Here $a_1 = 15$, $a_4 = 27$, $n = 4$.

$$\text{As } a_n = a_1 + (n-1)d$$

$$a_4 = a_1 + (4-1)d \text{ put values}$$

$$\Rightarrow 27 = 15 + 3d$$

$$\Rightarrow 27 - 15 = 3d \text{ or } 3d = 12$$

$$\Rightarrow d = \frac{12}{3} = 4$$

$$\text{As } A_1 = a + d = 15 + 4 = 19$$

$$A_2 = a + 2d = 15 + 2(4) = 15 + 8 = 23$$

Thus required arithmetic Means are 19 and 23.

Q.8: Insert three arithmetic Mean between 10 and 16.

Solution: Let A_1, A_2, A_3 be three arithmetic mean between 10 and 16. Then

10, $A_1, A_2, A_3, 16$ is A.P.

Here $a_1 = 10$, $a_5 = 16$, $n = 5$

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$$\text{As } a_n = a_1 + (n-1)d$$

$$a_5 = a_1 + (5-1)d \quad \text{put values}$$

$$\Rightarrow 16 = 10 + 4d$$

$$\Rightarrow 16 - 10 = 4d \quad \text{or } 4d = 6$$

$$\Rightarrow d = \frac{6}{4} = \frac{3}{2}$$

$$\text{As } A_1 = a + d = 10 + \frac{3}{2} = \frac{20+3}{2} = \frac{23}{2}$$

$$A_2 = a + 2d = 10 + 2\left(\frac{3}{2}\right) = 10 + 3 = 13$$

$$A_3 = a + 3d = 10 + 3\left(\frac{3}{2}\right) = \frac{20+9}{2} = \frac{29}{2}$$

Thus required arithmetic Means are $\frac{23}{2}, 13, \frac{29}{2}$.

Q.9: Insert four arithmetic Mean between -12 and 13.

Solution; Let A_1, A_2, A_3, A_4 be four arithmetic mean between -12 and 13. Then

-12, $A_1, A_2, A_3, A_4, 13$ is A.P.

Here $a_1 = -12$, $a_6 = 13$, $n = 6$

$$\text{As } a_n = a_1 + (n-1)d$$

$$a_6 = a_1 + (5-1)d \quad \text{put values}$$

$$\Rightarrow 13 = -12 + 5d$$

$$\Rightarrow 13 + 12 = 5d \quad \text{or } 5d = 25$$

$$\Rightarrow d = \frac{25}{5} = 5$$

$$\text{As } A_1 = a + d = -12 + 5 = -7$$

$$A_2 = a + 2d = -12 + 2(5) = -12 + 10 = -2$$

$$A_3 = a + 3d = -12 + 3(5) = -12 + 15 = 3$$

$$A_4 = a + 4d = -12 + 4(5) = -12 + 20 = 8$$

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Thus required arithmetic Means are $-7, -2, 3, 8$.

Geometric sequence (G.P.): A sequence in which each term is obtained from its preceding term by multiplying a constant (fixed) term is called geometric sequence or geometric progression. It is denoted by G.P.

The constant term is the common ratio between any two consecutive terms. It is denoted by " r ".

General term of G.P.: If " a " is the first term and " r " is the common ratio of a G.P., then the general is given by $a_n = ar^{n-1}$

Exercise 7.4 :

Q.1: Find next four terms of the following G.Ps :

(i) $16, 4, 1, \dots$ (ii) $1, \frac{1}{3}, \frac{1}{9}, \dots$

Solution: (i) Here $a_1 = 16, a_2 = 4$

$$\text{Then } r = \frac{a_2}{a_1} = \frac{4}{16} = \frac{1}{4}$$

Now next four terms are

$$a_4 = ar^3 = 16\left(\frac{1}{4}\right)^3 = 16\left(\frac{1}{64}\right) = \frac{1}{4}$$

$$a_5 = ar^4 = 16\left(\frac{1}{4}\right)^4 = 16\left(\frac{1}{256}\right) = \frac{1}{16}$$

$$a_6 = ar^5 = 16\left(\frac{1}{4}\right)^5 = 16\left(\frac{1}{1024}\right) = \frac{1}{64}$$

$$a_7 = ar^6 = 16\left(\frac{1}{4}\right)^6 = 16\left(\frac{1}{6144}\right) = \frac{1}{384}$$

Thus next four terms are $\frac{1}{4}, \frac{1}{16}, \frac{1}{64}, \frac{1}{384}$.

(ii) Here $a_1 = 1, a_2 = \frac{1}{3}$

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$$\text{Then } r = \frac{a_2}{a_1} = \frac{1/3}{1} = \frac{1}{3}$$

Now next four terms are

$$a_4 = ar^3 = 1 \left(\frac{1}{3} \right)^3 = \frac{1}{27}$$

$$a_5 = ar^4 = 1 \left(\frac{1}{3} \right)^4 = \frac{1}{81}$$

$$a_6 = ar^5 = 1 \left(\frac{1}{3} \right)^5 = \frac{1}{243}$$

$$a_7 = ar^6 = 1 \left(\frac{1}{3} \right)^6 = \frac{1}{729}$$

Thus next four terms are $\frac{1}{27}, \frac{1}{81}, \frac{1}{243}, \frac{1}{729}$.

Q.2: Find 12th term of the G.P. 4, 8, 16,

Solution: (i) Here $a_1 = 4$, $a_2 = 8$

$$\text{Then } r = \frac{a_2}{a_1} = \frac{8}{4} = 2$$

As we know that $a_n = ar^{n-1}$ (i), put $a = 4$, $r = 2$, $n = 12$

$$\Rightarrow a_{12} = (4)(2)^{12-1} = 2^2 \cdot 2^{11} = 2^{13}$$

In questions 3 – 6 one of n , r , a and a_n is missing, find it.

Q.3: $a_n = 768$, $a = 3$, $r = 2$

Solution: As we know that $a_n = ar^{n-1}$ (i)

put $a_n = 768$, $a = 3$, $r = 2$

$$\Rightarrow 768 = (3)(2)^{n-1} \Rightarrow \frac{768}{3} = 2^{n-1}$$

$$\text{or } 2^{n-1} = 256 \Rightarrow 2^{n-1} = 2^8 \text{ comparing the powers}$$

$$\Rightarrow n-1 = 8 \Rightarrow n = 8+1 = 9$$

Q.4: $a_n = 256$, $a = 4$, $n = 4$

Solution: As we know that $a_n = ar^{n-1}$ (i)

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$$\text{put } a_n = 256, a = 4, n = 4$$

$$\Rightarrow 256 = (4)r^{4-1} \Rightarrow \frac{256}{4} = r^3$$

$$\text{or } r^3 = 64 \Rightarrow r^3 = 4^3 \text{ comparing the base}$$

$$\Rightarrow r = 4$$

Q.5: $n = 7, r = 2$ and $a_n = 192$

Solution: $n = 7, r = 2$ and $a_n = 192$

As we know that $a_n = ar^{n-1} \dots (i)$

$$\text{put } n = 7, r = 2 \text{ and } a_n = 192$$

$$\Rightarrow 192 = a(2)^{7-1} \Rightarrow 192 = a(2)^6$$

$$\Rightarrow 192 = 64 a$$

$$\Rightarrow a = \frac{192}{64} = 3$$

Q.6: $a = 3, r = \frac{1}{2}, n = 7$

$$a = 3, r = \frac{1}{2}, n = 7$$

Solution:

As we know that $a_n = ar^{n-1} \dots (i)$

Put $a = 3, r = \frac{1}{2}, n = 7$ in (i)

$$a_7 = 3\left(\frac{1}{2}\right)^{7-1} = 3\left(\frac{1}{2}\right)^6 = 3\left(\frac{1}{2^6}\right)$$

$$\Rightarrow a_7 = \frac{3}{64}$$

Q.7: If $a_3 = 4$ and $a_8 = \frac{1}{256}$ find the value of a and r

Solution: As $a_3 = ar^2 = 4 \dots (i)$

and $a_8 = ar^7 = \frac{1}{256} \dots (ii)$

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Divided (ii) by (i) .

$$\frac{ar^7}{ar^2} = \frac{1/256}{4}$$

$$\Rightarrow r^{7-2} = \frac{1}{256 \times 4} \Rightarrow r^5 = \frac{1}{1024}$$

$$\Rightarrow r^5 = \left(\frac{1}{4}\right)^5 \text{ comparing base}$$

$$\Rightarrow r = \frac{1}{4}$$

Put $r = \frac{1}{4}$ in (i)

$$a\left(\frac{1}{4}\right)^2 = 4 \Rightarrow \frac{a}{16} = 4$$

$$\Rightarrow a = 16 \times 4 = 64$$

Q.8: If $2x$, $2x+2$ and $20x+4$ are the first three consecutive terms of G.P, then

(a) find the value of x (b) the common ratio .

Solution: As $2x$, $2x+2$ and $20x+4$ are the first three consecutive terms of G.P, then

$$a_1 = 2x, a_2 = 2x+2, a_3 = 20x+4$$

$$\text{Then } r = \frac{a_2}{a_1} = \frac{a_3}{a_2} \text{ put values}$$

$$\Rightarrow \frac{2x+2}{2x} = \frac{20x+4}{2x+2}$$

$$\Rightarrow \frac{2(x+1)}{2x} = \frac{2(10x+2)}{2(x+1)}$$

$$\Rightarrow \frac{x+1}{x} = \frac{10x+2}{x+1} \Rightarrow (x+1)(x+1) = x(10x+2)$$

$$\Rightarrow x^2 + x + x + 1 = 10x^2 + 2x$$

$$\Rightarrow 0 = 10x^2 - x^2 + 2x - x - x - 1$$

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$$\Rightarrow 0 = 9x^2 - 1 \quad \text{or} \quad 9x^2 - 1 = 0$$

$$\Rightarrow 9x^2 = 1 \quad \text{or} \quad x^2 = \frac{1}{9}, \text{ take square root of both sides}$$

$$\Rightarrow \sqrt{x^2} = \pm \sqrt{\frac{1}{9}} \Rightarrow x = \pm \frac{1}{3}$$

(b) Common ratio

Put $x = \frac{1}{3}$, then

$$a_1 = 2\left(\frac{1}{3}\right) = \frac{2}{3}$$

$$a_2 = 2\left(\frac{1}{3}\right) + 2 = \frac{2}{3} + 2 = \frac{2+6}{3} = \frac{8}{3}$$

$$\text{Now } r = \frac{a_2}{a_1} = \frac{8/3}{2/3} = \frac{8}{3} \times \frac{3}{2} = 4$$

Put $x = -\frac{1}{3}$, then

$$a_1 = 2\left(-\frac{1}{3}\right) = -\frac{2}{3}$$

$$a_2 = 2\left(-\frac{1}{3}\right) + 2 = -\frac{2}{3} + 2 = \frac{-2+6}{3} = \frac{4}{3}$$

$$\text{Now } r = \frac{a_2}{a_1} = \frac{4/3}{-2/3} = -\frac{4}{3} \times \frac{3}{2} = -2$$

Q.9: Find three consecutive numbers in G.P. whose sum is 19 and their products is 216.

Solution: Let a, ar, ar^2 be three consecutive numbers in G.P. Then according to the given conditions,

$$a + ar + ar^2 = 19 \Rightarrow a(1 + r + r^2) = 19 \dots\dots(i)$$

$$\text{And } (a)(ar)(ar^2) = 216 \Rightarrow a^3 r^3 = 216$$

$$\Rightarrow (ar)^3 = 216, \text{ Taking cube root of both sides.}$$

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$$\Rightarrow (ar)^{3 \times \frac{1}{3}} = (6)^{3 \times \frac{1}{3}}$$

$$\Rightarrow ar = 6 \Rightarrow a = \frac{6}{r} \dots\dots(ii)$$

Put (ii) in (i)

$$\frac{6}{r}(1+r+r^2)=19 \Rightarrow 6(1+r+r^2)=19r$$

$$\Rightarrow 6+6r+6r^2=19r \Rightarrow 6r^2+6r-19r+6=0$$

$$\Rightarrow 6r^2-13r+6=0 \Rightarrow 6r^2-9r-4r+6=0$$

$$\Rightarrow 3r(2r-3)-2(2r-3)=0 \Rightarrow (2r-3)(3r-2)=0$$

$$\Rightarrow 2r-3=0 \text{ or } 3r-2=0$$

$$\Rightarrow 2r=3 \text{ or } 3r=2$$

$$\Rightarrow r=\frac{3}{2} \text{ or } r=\frac{2}{3}$$

Put $r=\frac{2}{3}$ in(ii).

$$a=\frac{6}{3/2}=\frac{6}{3} \times 2=2 \times 2=4$$

Now take $r=\frac{2}{3}$ and $a=4$, then

$$ar=4\left(\frac{2}{3}\right)=(2)(3)=6$$

$$ar^2=4\left(\frac{2}{3}\right)^2=4\left(\frac{4}{9}\right)=\frac{16}{9}$$

Put $r=\frac{3}{2}$ in(ii).

$$a=\frac{6}{2/3}=\frac{6}{2} \times 3=3 \times 3=9$$

Now take $r=\frac{3}{2}$ and $a=9$, then

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$$ar = 9\left(\frac{2}{3}\right) = (3)(2) = 6$$

$$ar^2 = 9\left(\frac{2}{3}\right)^2 = 9\left(\frac{4}{9}\right) = 4$$

Thus the numbers are 4, 6, 9 or 9, 6, 4.

Geometric mean between two numbers (G.M.):

Let G be a geometric mean between two numbers a and b

If a, G, b is a G.P. Then

$$\frac{G}{a} = \frac{b}{G} \Rightarrow G^2 = ab$$

$$\Rightarrow \sqrt{G^2} = \pm\sqrt{ab}$$

$\Rightarrow G = \pm\sqrt{ab}$ is the required formula of G.M. between a and b .

Inserting n – geometric means between two numbers:

Let G_1, G_2, \dots, G_n are n geometric means between a and b . Then

$a, G_1, G_2, \dots, G_n, b$ form G.P.

Here number of terms are " $n+2$ ".

First term is " a " and last term ($n+2$) term is " b ".

From the first and last term find common ratio " r ".

Then $G_1 = a_2 = ar$

$$G_2 = a_3 = ar^2$$

$$G_3 = a_4 = ar^3$$

.....

.....

$$G_n = a_n = ar^n$$

Exercise 7.5:

Q.1: Find geometric between

(i) 4 and 9 (ii) $\frac{1}{4}$ and 832

Solution: (i) 4 and 9

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As Geometric mean between two numbers a and b is

$$G = \pm\sqrt{ab} \dots\dots(i), \text{ put } a=4, b=9 \text{ in (i)}$$

$$\Rightarrow G = \pm\sqrt{(4)(9)} = \pm\sqrt{36} = \pm 6$$

ii) $\frac{1}{4}$ and 832

As Geometric mean between two numbers a and b is

$$G = \pm\sqrt{ab} \dots\dots(i), \text{ put } a=\frac{1}{4}, b=832 \text{ in (i)}$$

$$\Rightarrow G = \pm\sqrt{\left(\frac{1}{4}\right)(832)} = \pm\sqrt{208} = \pm\sqrt{16 \times 13} = \pm 4\sqrt{13}$$

Q.2: Insert two geometric means between 3 and 648.

Solution: Let G_1, G_2 are two geometric means between 3 and 648. Then

3, $G_1, G_2, 648$ are in G.P.

Here $a_1 = 3, a_4 = 648$

Since $a_4 = ar^3$ put values

$$\Rightarrow 648 = 3r^3 \Rightarrow \frac{648}{3} = r^3$$

$$\Rightarrow r^3 = 216 \Rightarrow r^3 = (6)^3, \text{ take cube root of both sides}$$

$$\Rightarrow r^{3 \times \frac{1}{3}} = 6^{3 \times \frac{1}{3}} \Rightarrow r = 6$$

Now $G_1 = ar = 3(6) = 18$

$$G_2 = ar^2 = 3(6)^2 = 3(36) = 108$$

Thus required G.M. are 18 and 108.

Q.3: Insert four geometric means between $\frac{1}{5}$ and 625.

Solution: Let G_1, G_2, G_3, G_4 are four geometric means between $\frac{1}{5}$ and 625. Then

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$\frac{1}{5}$, G_1, G_2, G_3, G_4 , 625 are in G . P.

Here $a_1 = \frac{1}{5}$, $a_6 = 625$

Since $a_6 = ar^5$ put values

$$\Rightarrow 625 = \frac{1}{5}r^5 \Rightarrow 625 \times 5 = r^5$$

$$\Rightarrow r^5 = 5^4 \times 5 \Rightarrow r^5 = 5^5 ,$$

$$\Rightarrow r = 5 \text{ comparing base .}$$

$$\text{Now } G_1 = ar = \frac{1}{5}(5) = 1$$

$$G_2 = ar^2 = \frac{1}{5}(5)^2 = \frac{1}{5}(25) = 5$$

$$G_3 = ar^3 = \frac{1}{5}(5)^3 = \frac{1}{5}(125) = 25$$

$$G_4 = ar^4 = \frac{1}{5}(5)^4 = \frac{1}{5}(625) = 125$$

Thus required G.M. are 5 , 25 and 125 .

Q.4: Insert five geometric means between $\frac{3}{4}$ and $\frac{16}{243}$.

Solution: Let G_1, G_2, G_3, G_4, G_5 are five geometric means

between $\frac{3}{4}$ and $\frac{16}{243}$. Then

$\frac{3}{4}$, $G_1, G_2, G_3, G_4, G_5, \frac{16}{243}$ are in G . P.

Here $a_1 = \frac{3}{4}$, $a_7 = \frac{16}{243}$

Since $a_7 = ar^6$ put values

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$$\Rightarrow \frac{16}{243} = \frac{3}{4} r^6 \Rightarrow \frac{16}{243} \times \frac{4}{3} = r^6$$

$$\Rightarrow r^6 = \frac{64}{3^5 \times 3} \Rightarrow r^6 = \frac{2^6}{3^6} \Rightarrow r^6 = \left(\frac{2}{3}\right)^6,$$

$$\Rightarrow r = \frac{2}{3} \quad \text{comparing base.}$$

Now $G_1 = ar = \frac{3}{4} \left(\frac{2}{3}\right) = \frac{1}{2}$

$$G_2 = ar^2 = \frac{3}{4} \left(\frac{2}{3}\right)^2 = \frac{3}{4} \left(\frac{4}{9}\right) = \frac{1}{3}$$

$$G_3 = ar^3 = \frac{3}{4} \left(\frac{2}{3}\right)^3 = \frac{3}{4} \left(\frac{8}{27}\right) = \frac{2}{9}$$

$$G_4 = ar^4 = \frac{3}{4} \left(\frac{2}{3}\right)^4 = \frac{3}{4} \left(\frac{16}{81}\right) = \frac{4}{27}$$

$$G_5 = ar^5 = \frac{3}{4} \left(\frac{2}{3}\right)^5 = \frac{3}{4} \left(\frac{32}{243}\right) = \frac{8}{81}$$

Thus required G.M. are $\frac{1}{2}, \frac{1}{3}, \frac{2}{9}, \frac{4}{27}, \frac{8}{81}$.

Q.5: If the arithmetic mean between two numbers is 8 and positive geometric mean is $\sqrt{60}$. Find the numbers.

Solution: Let a and b are the required numbers.

Then $A.M = \frac{a+b}{2}$ put values

$$\Rightarrow 8 = \frac{a+b}{2} \Rightarrow a+b = 2 \times 8$$

$$\Rightarrow a+b = 16 \Rightarrow a = 16 - b \dots\dots(i)$$

Also $G.M. = \sqrt{ab} \Rightarrow \sqrt{60} = \sqrt{ab}$

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$$\Rightarrow (\sqrt{ab})^2 = (\sqrt{60})^2$$

$$\Rightarrow ab = 60 \quad \dots\dots(ii) \quad \text{put (i) in (ii).}$$

$$(16-b)b = 60 \Rightarrow 16b - b^2 = 60$$

$$\Rightarrow 0 = b^2 - 16b + 60 \text{ or } b^2 - 16b + 60 = 0$$

$$\Rightarrow b^2 - 6b - 10b + 60 = 0$$

$$\Rightarrow b(b-6) - 10(b-6) = 0$$

$$\Rightarrow (b-6)(b-10) = 0$$

$$\Rightarrow b-6 = 0 \text{ or } b-10 = 0$$

$$\Rightarrow b = 6 \text{ or } b = 10$$

Put $b = 6$ in (i) $\Rightarrow a = 16 - 6 = 10$

Put $b = 10$ in (i) $\Rightarrow a = 16 - 10 = 6$

Thus required numbers are 10, 6 or 6, 10.

Exercise 7.6 (Objective type Questions).

Q.1: True and False questions .

Read the following questions carefully and select "T" in case of true statement and "F" in case of false statement .

- (i) 1, 5, -6, 9, 0, is a sequence . T - F
- (ii) 5, 10, 15, is a non - sequence T - F
- (iii) If the first term and common differences are given then we can write whole arithmetic sequence . T - F
- (iv) $A = \pm\sqrt{ab}$ T - F
- (v) $a_n = a + (n-1)d$ T - F

Answers: (i) F (ii) F (iii) T (iv) F (v) T

Q.2: Fill in the blanks .

- (i) If the difference between any two consecutive terms of a sequence is the same then it is said be
- (ii) 1, 4, 9, is a
- (iii) General term of G . P . is
- (iv) Arithmetic mean between a and b is
- (v) Geometric mean between a and b is

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Answers: (i) Arithmetic sequence (ii) sequence

(iii) $a_n = ar^{n-1}$ (iv) $\frac{a+b}{2}$ (v) $\pm\sqrt{ab}$

Q.3: Select the correct answer and write a, b, c or d in the box.

(i) $\frac{1}{2}, \frac{3}{2}, \frac{5}{2}, \dots$ is

- (a) an A.P. (b) G.P.
 (c) both A.P. and G.P. (d) non of these

(ii) Arithmetic mean between $2\sqrt{3}$ and $6\sqrt{3}$ is

- (a) $8\sqrt{3}$ (b) 24 (c) $4\sqrt{3}$ (d) $12\sqrt{3}$

(iii) In a sequence if $a = 2$, $d = 3$ then 5th term is

- (a) 17 (b) 14 (c) 6 (d) 12

(iv) Geometric mean between $\frac{1}{3}$ and $\frac{4}{3}$ is

- (a) $\pm\frac{4}{9}$ (b) $\pm\frac{5}{3}$ (c) $\pm\frac{2}{3}$ (d) $\pm\frac{5}{9}$

(v) If $a = \frac{125}{8}$, $r = \frac{2}{5}$, $n = 8$ then $a_n = \dots$

- (a) $\frac{8}{125}$ (b) $\frac{625}{16}$ (c) $\frac{16}{625}$ (d) $\frac{24}{125}$

(vi) The General term of the sequence $-1, 1, -1, 1, \dots$ is

- (a) $(-1)^{n+1}$ (b) $(-1)^{n^2}$ (c) $-n$ (d) $(-1)^n$

(vii) The 10th term of A.P. $2, \frac{5}{2}, 3, \dots$ is

- (a) $\frac{15}{2}$ (b) $\frac{2}{13}$ (c) $\frac{11}{2}$ (d) $\frac{13}{2}$

(viii) An arithmetic mean between $\sqrt{5}-4$ and $\sqrt{5}+4$ is

- (a) 4 (b) -4 (c) $\sqrt{5}$ (d) $-\sqrt{5}$

Answers: (i) a (ii) c (iii) b (iv) c (v) c
 (vi) d (vii) d (viii) c

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Unit 8:

Sets and Functions:

Set: A collection of well defined and distinct objects is called a set. A set is generally denoted by capital letters of English alphabets A, B, C, ..., Z. The objects of a set are called elements or members and denoted by small letters of English alphabets a, b, c, ..., z. If "x" is a member of a set A then it is written as $x \in A$. If x is not a member of A then we write $x \notin A$.

Methods of a set writing: A set is writing by three methods

(i) **Descriptive Method** : In this method the elements of a set is writing by a sentence. For example

The set of first ten natural numbers.

(ii) **Tabular Method**: In this method the elements of a set is Written one by one. For example

$$A = \{ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 \}$$

(iii) **Set builder method** : In this method the elements of a Set is represented by x. i.e.

$$A = \{ x / x \in N, x \leq 10 \}$$

Some important set:

(i) Set of natural numbers = $N = \{ 1, 2, 3, \dots \}$

(ii) Set whole numbers = $W = \{ 0, 1, 2, \dots \}$

(iii) Set of integers = $Z = \{ 0, \pm 1, \pm 2, \pm 3, \dots \}$

(iv) Set of even numbers = $E = \{ 0, \pm 2, \pm 4, \dots \}$

(v) Set of odd numbers = $O = \{ \pm 1, \pm 3, \pm 5, \dots \}$

(vi) Set of prime numbers = $P = \{ 2, 3, 5, 7, 11, \dots \}$

(vii) Set of rational numbers =

$$Q = \{ x / x \in \frac{p}{q}, p, q \in Z, q \neq 0 \}$$

Union of two sets: The union of two sets A and B is a set Which contains the elements of set A or set B or both sets A and B. It is denoted by $A \cup B$.

In set builder form $A \cup B = \{ x / x \in A \vee x \in B \}$.

Intersection of two sets: Intersection of two sets A and B is a

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set which contains the common elements of set A and set B .

It is denoted by $A \cap B$. In set builder form

$$A \cap B = \{x / x \in A \wedge x \in B\}$$

Difference of two sets : The difference of two sets A and B is denoted by $A - B$ or A / B and contains those elements of set A which does not belong to B . In set builder form

$$A - B = \{x / x \in A \wedge x \notin B\}$$

Complement of a set: Complement of a set A is a set which Contains those elements of universal set which does not belong to set A . It is denoted by A' or A^c

Exercise 5.1:

Q.1: If $A = \{1, 2, 3\}$, $B = \{0, 1\}$ and $C = \{1, 3, 4\}$ then find

- (i) $A \cup B$ (ii) $A \cap B$ (iii) $A \cup C$
 (iv) $A \cap C$ (v) $B \cup C$ (vi) $A \cap A$

Solution: (i) $A \cup B$

$$A \cup B = \{1, 2, 3\} \cup \{0, 1\}$$

$$= \{0, 1, 2, 3\}$$

(ii) $A \cap B = \{1, 2, 3\} \cap \{0, 1\} = \{1\}$

(iii) $A \cup C = \{1, 2, 3\} \cup \{1, 3, 4\} = \{1, 2, 3, 4\}$

(iv) $A \cap C = \{1, 2, 3\} \cap \{1, 3, 4\} = \{1, 3\}$

(v) $B \cup C = \{0, 1\} \cup \{1, 3, 4\} = \{0, 1, 3, 4\}$

(vi) $A \cap A = \{1, 2, 3\} \cap \{1, 2, 3\} = \{1, 2, 3\}$

Q.2: Find A / B and B / A when

(i) $A = \{1, 3, 5, 7\}$, $B = \{3, 4, 5, 6, 7, 8\}$

(ii) $A = \{0, \pm 1, \pm 2, \pm 3\}$, $B = \{-1, -2, -3\}$

(iii) $A = \{1, 2, 3, 4, \dots\}$, $B = \{1, 3, 5, 7, \dots\}$

Solution: (i) $A / B = \{1, 3, 5, 7\} / \{3, 4, 5, 6, 7, 8\}$

$$\Rightarrow A / B = \{1\}$$

$$B / A = \{3, 4, 5, 6, 7, 8\} / \{1, 3, 5, 7\}$$

$$\Rightarrow B / A = \{4, 6, 8\}$$

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(ii) $A = \{0, \pm 1, \pm 2, \pm 3\}$, $B = \{-1, -2, -3\}$

$$A/B = \{0, \pm 1, \pm 2, \pm 3\} / \{-1, -2, -3\}$$

$$\Rightarrow A/B = \{0, 1, 2, 3\}$$

$$B/A = \{-1, -2, -3\} / \{0, \pm 1, \pm 2, \pm 3\}$$

$$\Rightarrow B/A = \{\}$$

(iii) $A = \{1, 2, 3, 4, \dots\}$, $B = \{1, 3, 5, 7, \dots\}$

$$A/B = \{1, 2, 3, 4, \dots\} / \{1, 3, 5, 7, \dots\}$$

$$\Rightarrow A/B = \{2, 4, 6, \dots\}$$

$$B/A = \{1, 3, 5, 7, \dots\} / \{1, 2, 3, 4, \dots\}$$

$$\Rightarrow B/A = \{\}$$

Q.3: If $U = \{1, 2, 3, \dots, 20\}$, $A = \{2, 4, 6, \dots, 20\}$,

$B = \{1, 3, 5, \dots, 19\}$ and $C = \phi$ then find

(i) A' (ii) B' (iii) C' (iv) $A \cup B'$ (v) $A' \cap B'$

(vi) $A' \cap B$ (vii) $A' \cup C'$ (viii) $A \cap C'$ (ix) $C' \cap C$

(x) $B' \cup C'$

Solution: (i) A'

$$A' = U/A = \{1, 2, 3, \dots, 20\} / \{2, 4, 6, \dots, 20\}$$

$$\Rightarrow A' = \{1, 3, 5, \dots, 19\} \dots (i)$$

(ii) B'

$$B' = U/B = \{1, 2, 3, \dots, 20\} / \{1, 3, 5, \dots, 19\}$$

$$\Rightarrow B' = \{2, 4, 6, \dots, 20\} \dots (ii)$$

(iii) C'

$$C' = U/C = \{1, 2, 3, \dots, 20\} / \phi$$

$$\Rightarrow C' = \{1, 2, 3, \dots, 20\} \dots (iii)$$

(iv) $A \cup B'$

From (i) $A' = \{1, 3, 5, \dots, 19\}$

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From (ii) $B' = \{2, 4, 6, \dots, 20\}$

$$A' \cup B' = \{1, 3, 5, \dots, 19\} \cup \{2, 4, 6, \dots, 20\}$$

$$= \{1, 2, 3, 4, \dots, 20\}$$

(v) $A' \cap B'$

From (i) $A' = \{1, 3, 5, \dots, 19\}$

From (ii) $B' = \{2, 4, 6, \dots, 20\}$

$$A' \cap B' = \{1, 3, 5, \dots, 19\} \cap \{2, 4, 6, \dots, 20\}$$

$$= \{\}$$

(vi) $A' \cap B$

From (i) $A' = \{1, 3, 5, \dots, 19\}$

$$A' \cap B = \{1, 3, 5, \dots, 19\} \cap \{1, 3, 5, \dots, 19\}$$

$$= \{1, 3, 5, \dots, 19\}$$

(vii) $A' \cup C'$

From (i) $A' = \{1, 3, 5, \dots, 19\}$

From (iii) $C' = \{1, 2, 3, \dots, 20\}$

$$A' \cup C' = \{1, 3, 5, \dots, 19\} \cup \{1, 2, 3, \dots, 20\}$$

$$= \{1, 2, 3, \dots, 20\}$$

(viii) $A \cap C'$

From (iii) $C' = \{1, 2, 3, \dots, 20\}$

$$A \cap C' = \{2, 4, 6, \dots, 20\} \cap \{1, 2, 3, \dots, 20\}$$

$$= \{2, 4, 6, \dots, 20\}$$

(ix) $C' \cap C$

From (iii) $C' = \{1, 2, 3, \dots, 20\}$

$$C' \cap C = \{1, 2, 3, \dots, 20\} \cap \phi$$

$$= \phi$$

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(x) $B' \cup C'$

$$\text{From (ii)} \quad B' = \{2, 4, 6, \dots, 20\}$$

$$\text{From (iii)} \quad C' = \{1, 2, 3, \dots, 20\}$$

$$\begin{aligned} B' \cup C' &= \{2, 4, 6, \dots, 20\} \cup \{1, 2, 3, \dots, 20\} \\ &= \{1, 2, 3, \dots, 20\} \end{aligned}$$

Q.4: If U = set of integers up to ± 20 .

and A = set of positive integers up to 10

and B = set of negative integers up to -5, then find

(i) $A' \cup B'$ (ii) $A' \cap B'$ (iii) U' (iv) ϕ'

(v) $B \cap A'$ (vi) $B \cup B'$ (vii) $A \cap A'$ (viii) $A \cup B'$

Solution: $U = \{0, \pm 1, \pm 2, \pm 3, \dots, \pm 20\}$

$$A = \{1, 2, 3, 4, \dots, 10\}$$

$$B = \{-1, -2, -3, -4, -5\}$$

(i) $A' \cup B'$

$$A' = U / A = \{0, \pm 1, \pm 2, \pm 3, \dots, \pm 20\} / \{1, 2, 3, \dots, 10\}$$

$$\Rightarrow A' = \{-20, -19, \dots, -1, 0, 11, 12, \dots, 20\} \dots (i)$$

$$B' = U / B = \{0, \pm 1, \pm 2, \pm 3, \dots, \pm 20\} / \{-1, -2, -3, -4, -5\}$$

$$\Rightarrow B' = \{-20, -19, \dots, -7, -6, 0, 1, 2, \dots, 20\} \dots (ii)$$

$$A' \cup B' = \{-20, -19, -18, \dots, -1, 0, 11, 12, \dots, 20\}$$

$$\cup \{-20, -19, -18, \dots, -7, -6, 0, 1, 2, \dots, 20\}$$

$$= \{-20, -19, -18, \dots, -1, 0, 1, 2, 3, 4, \dots, 20\}$$

(ii) $A' \cap B'$

$$\text{From (i)} \Rightarrow A' = \{-20, -19, \dots, -1, 0, 11, 12, \dots, 20\}$$

$$\text{From (ii)} \Rightarrow B' = \{-20, -19, \dots, -7, -6, 0, 1, 2, \dots, 20\}$$

$$A' \cap B' = \{-20, -19, -18, \dots, -1, 0, 11, 12, \dots, 20\}$$

$$\cap \{-20, -19, -18, \dots, -7, -6, 0, 1, 2, \dots, 20\}$$

$$= \{-20, -19, -18, \dots, -7, -6, 0, 11, 12, \dots, 20\}$$

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(iii) U'

$$U' = U/U = \{0, \pm 1, \pm 2, \pm 3, \dots, \pm 20\} / \{0, \pm 1, \pm 2, \pm 3, \dots, \pm 20\}$$

$$\Rightarrow U' = \phi$$

(iv) ϕ'

$$\phi' = U/\phi = \{0, \pm 1, \pm 2, \pm 3, \dots, \pm 20\} / \phi$$

$$= \{0, \pm 1, \pm 2, \pm 3, \dots, \pm 20\}$$

(v) $B \cap A'$

$$\text{From (i)} \Rightarrow A' = \{-20, -19, \dots, -1, 0, 11, 12, \dots, 20\}$$

$$B \cap A' = \{-1, -2, \dots, -5\} \cap \{-20, -19, \dots, -1, 0, 11, 12, \dots, 20\}$$

$$= \{-1, -2, -3, -4, -5\}$$

(vi) $B \cup B'$

$$\text{From (ii)} \Rightarrow B' = \{-20, -19, \dots, -7, -6, 0, 1, 2, \dots, 20\}$$

$$B \cup B' = \{-1, -2, \dots, -5\} \cup \{-20, -19, \dots, -7, -6, 0, 1, 2, \dots, 20\}$$

$$= \{-20, -19, \dots, -1, 0, 1, 2, \dots, 20\} = U$$

(vii) $A \cap A'$

$$\text{From (i)} \Rightarrow A' = \{-20, -19, \dots, -1, 0, 11, 12, \dots, 20\}$$

$$A \cap A' = \{1, 2, \dots, 10\} \cap A' = \{-20, -19, \dots, -1, 0, 11, 12, \dots, 20\}$$

$$= \phi$$

(viii) $A \cup B'$

$$\text{From (ii)} \Rightarrow B' = \{-20, -19, \dots, -7, -6, 0, 1, 2, \dots, 20\}$$

$$A \cup B' = \{1, 2, \dots, 10\} \cup \{-20, -19, \dots, -7, -6, 0, 1, 2, \dots, 20\}$$

$$= \{-20, -19, \dots, -7, -6, 0, 1, 2, \dots, 20\}$$

Properties of union and intersection:

(a) Commutative property of union:

$$A \cup B = B \cup A$$

(b) Commutative property of intersection:

$$A \cap B = B \cap A$$

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(c) Associative property of union:

$$A \cup (B \cap C) = (A \cup B) \cap C$$

(d) Associative property of intersection:

$$A \cap (B \cup C) = (A \cap B) \cup C$$

Exercise 8.2:

Verify commutative property of union and intersection for the following sets:

Q.1: $A = \{1, 2, 3, \dots, 12\}$, $B = \{2, 4, 5, 8, 10, 12\}$

Solution: $A = \{1, 2, 3, \dots, 12\}$, $B = \{2, 4, 5, 8, 10, 12\}$

(a) Commutative property of Union : $A \cup B = B \cup A$.

$$\begin{aligned} A \cup B &= \{1, 2, 3, \dots, 12\} \cup \{2, 4, 5, 8, 10, 12\} \\ &= \{1, 2, 3, \dots, 12\} \dots\dots(i) \end{aligned}$$

$$\begin{aligned} B \cup A &= \{2, 4, 5, 8, 10, 12\} \cup \{1, 2, 3, \dots, 12\} \\ \Rightarrow B \cup A &= \{1, 2, 3, \dots, 12\} \dots\dots(ii) \end{aligned}$$

From (i) and (ii) it is proved $A \cup B = B \cup A$.

(b) Commutative property of intersection: $A \cap B = B \cap A$

$$\begin{aligned} A \cap B &= \{1, 2, 3, \dots, 12\} \cap \{2, 4, 5, 8, 10, 12\} \\ &= \{2, 4, 5, 8, 10, 12\} \dots\dots(i) \end{aligned}$$

$$\begin{aligned} \text{Now } B \cap A &= \{2, 4, 5, 8, 10, 12\} \cap \{1, 2, 3, \dots, 12\} \\ \Rightarrow B \cap A &= \{2, 4, 5, 8, 10, 12\} \dots\dots(ii) \end{aligned}$$

From (i) and (ii) it is proved $A \cap B = B \cap A$

Q.2: $A = \{a, e, i, o, u\}$, $B = \{a, b, c, \dots, z\}$,

Solution:**(a) Commutative property of Union :** $A \cup B = B \cup A$.

$$\begin{aligned} \text{Now } A \cup B &= \{a, b, c, \dots, z\} \cup \{a, e, i, o, u\} \\ &= \{a, b, c, \dots, z\} \dots\dots(i) \end{aligned}$$

$$\begin{aligned} \text{Now } B \cup A &= \{a, e, i, o, u\} \cup \{a, b, \dots, z\} \\ &= \{a, b, \dots, z\} \dots\dots(ii) . \end{aligned}$$

From (i) and (ii) $A \cup B = B \cup A$ proved .

(b) Commutative property of intersection: $A \cap B = B \cap A$

$$\begin{aligned} \text{Now } A \cap B &= \{a, b, c, \dots, z\} \cap \{a, e, i, o, u\} \\ &= \{a, e, i, o, u\} \dots\dots(i) \end{aligned}$$

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$$\begin{aligned}\text{Now } B \cap A &= \{a, e, i, o, u\} \cap \{a, b, \dots, z\} \\ &= \{a, e, i, o, u\} \dots \dots (ii)\end{aligned}$$

From (i) and (ii) it is proved $A \cap B = B \cap A$

Q.3: $C = \{-1, -3, -5, -7, -9\}$, $B = \{-2, -4, -6, -8, -10\}$

Solution: (a) Commutative property of Union : $C \cup D = D \cup C$.

$$\begin{aligned}C \cup D &= \{-1, -3, -5, -7, -9\} \cup \{-2, -4, -6, -8, -10\} \\ &= \{-1, -2, -3, -4, \dots, -10\} \dots \dots (i)\end{aligned}$$

$$\begin{aligned}\text{Now } D \cup C &= \{-2, -4, -6, -8, -10\} \cup \{-1, -3, -5, -7, -9\} \\ &= \{-1, -2, -3, -4, \dots, -10\} \dots \dots (ii)\end{aligned}$$

From (i) and (ii) it is proved $C \cup D = D \cup C$.

(b) Commutative property of intersection: $C \cap D = D \cap C$.

$$\begin{aligned}C \cap D &= \{-1, -3, -5, -7, -9\} \cap \{-2, -4, -6, -8, -10\} \\ &= \{ \} \dots \dots (i)\end{aligned}$$

$$\begin{aligned}\text{Now } D \cap C &= \{-2, -4, -6, -8, -10\} \cap \{-1, -3, -5, -7, -9\} \\ &= \{ \} \dots \dots (ii)\end{aligned}$$

From (i) and (ii) it is proved $C \cap D = D \cap C$

Q.4: A = Set of first ten prime numbers.

B = Set of first ten composite numbers.

Solution: $A = \{2, 3, 5, 7, 11, 13, 17, 19, 23, 29\}$

$$B = \{4, 6, 8, 9, 10, 12, 14, 15, 16, 18\}$$

(a) Commutative property of Union : $A \cup B = B \cup A$

$$A \cup B = \{2, 3, 5, 7, 11, 13, 17, 19, 23, 29\}$$

$$\cup \{4, 6, 8, 9, 10, 12, 14, 15, 16, 18\}$$

$$= \{2, 3, 4, 5, \dots, 19, 23, 29\} \dots \dots (i)$$

$$\text{Now } B \cup A = \{4, 6, 8, 9, 10, 12, 14, 15, 16, 18\}$$

$$\cup \{2, 3, 5, 7, 11, 13, 17, 19, 23, 29\}$$

$$= \{2, 3, 4, 5, \dots, 19, 23, 29\} \dots \dots (ii)$$

From (i) and (ii) it is proved $A \cup B = B \cup A$.

(b) Commutative property of intersection: $A \cap B = B \cap A$

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$$\begin{aligned} A \cap B &= \{2, 3, 5, 7, 11, 13, 17, 19, 23, 29\} \\ &\cap \{4, 6, 8, 9, 10, 12, 14, 15, 16, 18\} \\ &= \{ \} \dots\dots(i) \end{aligned}$$

$$\begin{aligned} \text{Now } B \cap A &= \{4, 6, 8, 9, 10, 12, 14, 15, 16, 18\} \\ &\cap \{2, 3, 5, 7, 11, 13, 17, 19, 23, 29\} \\ &= \{ \} \dots\dots(ii) \end{aligned}$$

From (i) and (ii) it is proved $A \cap B = B \cap A$.

Q.5: $A = N$, $B = \{x/x \in N, x \text{ is an even integer}\}$

$$A = \{1, 2, 3, \dots\}, B = \{2, 4, 6, \dots\}$$

(a) Commutative property of Union: $A \cup B = B \cup A$

$$\begin{aligned} A \cup B &= \{1, 2, 3, \dots\} \cup \{2, 4, 6, \dots\} \\ &= \{1, 2, 3, \dots\} \dots\dots(i) \end{aligned}$$

$$\begin{aligned} \text{Now } B \cup A &= \{2, 4, 6, \dots\} \cup \{1, 2, 3, \dots\} \\ &= \{1, 2, 3, \dots\} \dots\dots(ii) \end{aligned}$$

From (i) and (ii) it is proved $A \cup B = B \cup A$.

(b) Commutative property of intersection: $A \cap B = B \cap A$

$$\begin{aligned} A \cap B &= \{1, 2, 3, \dots\} \cap \{2, 4, 6, \dots\} \\ &= \{2, 4, 6, \dots\} \dots\dots(i) \end{aligned}$$

$$\begin{aligned} \text{Now } B \cap A &= \{2, 4, 6, \dots\} \cap \{1, 2, 3, \dots\} \\ &= \{2, 4, 6, \dots\} \dots\dots(ii) \end{aligned}$$

From (i) and (ii) it is proved $A \cap B = B \cap A$.

Verify associative properties of union and intersection for the following sets:

Q.6: $L = \{0, \pm 1, \pm 2, \pm 3, \pm 4, \pm 5\}$

$$M = \{-1, -2, -3, -4, -5\}, N = \{1, 2, 3, 4, 5\}$$

Solution: (a) Associative property of union:

$$L \cup (M \cap N) = (L \cup M) \cap N.$$

Take L . H . S. $L \cup (M \cap N)$

$$\begin{aligned} M \cap N &= \{-1, -2, -3, -4, -5\} \cup \{1, 2, 3, 4, 5\} \\ &= \{\pm 1, \pm 2, \pm 3, \pm 4, \pm 5\} \end{aligned}$$

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$$LU(MUN) = \{0, \pm 1, \pm 2, \pm 3, \pm 4, \pm 5\}$$

$$U\{\pm 1, \pm 2, \pm 3, \pm 4, \pm 5\}$$

$$= \{0, \pm 1, \pm 2, \pm 3, \pm 4, \pm 5\} \dots\dots(i)$$

Take R.H.S. (LUM)UN .

$$LUM = \{0, \pm 1, \pm 2, \pm 3, \pm 4, \pm 5\} U \{-1, -2, -3, -4, -5\}$$

$$= \{0, \pm 1, \pm 2, \pm 3, \pm 4, \pm 5\}$$

$$(LUM)UN = \{0, \pm 1, \pm 2, \pm 3, \pm 4, \pm 5\} U \{1, 2, 3, 4, 5\}$$

$$= \{0, \pm 1, \pm 2, \pm 3, \pm 4, \pm 5\} \dots\dots(ii)$$

From (i) and (ii) it is proved $LU(MUN) = (LUM)UN$.

(b) Associative property of intersection:

$$L \cap (M \cap N) = (L \cap M) \cap N$$

Take L . H . S. $L \cap (M \cap N)$

$$MUN = \{-1, -2, -3, -4, -5\} U \{1, 2, 3, 4, 5\}$$

$$= \{ \}$$

$$L \cap (M \cap N) = \{0, \pm 1, \pm 2, \pm 3, \pm 4, \pm 5\} \cap \{ \}$$

$$= \{ \} \dots\dots(i)$$

Take R.H.S. $(L \cap M) \cap N$.

$$L \cap M = \{0, \pm 1, \pm 2, \pm 3, \pm 4, \pm 5\} \cap \{-1, -2, -3, -4, -5\}$$

$$= \{-1, -2, -3, -4, -5\}$$

$$(L \cap M) \cap N = \{-1, -2, -3, -4, -5\} \cap \{1, 2, 3, 4, 5\}$$

$$= \{ \} \dots\dots(ii)$$

From (i) and (ii) it is proved $L \cap (M \cap N) = (L \cap M) \cap N$.

Q.7: $A = \phi$, $B = \{0\}$, $C = \{0, 1, 2\}$

Solution: (a) Associative property of union:

$$AU(BUC) = (AUB)UC$$

Take L.H.S. $AU(BUC)$

$$BUC = \{0\} U \{0, 1, 2\}$$

$$= \{0, 1, 2\}$$

$$AU(BUC) = \phi U \{0, 1, 2\} = \{0, 1, 2\} \dots\dots(i)$$

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Take R.H.S. $(A \cup B) \cap C$

$$A \cup B = \emptyset \cup \{0\} = \{0\}$$

$$(A \cup B) \cap C = \{0\} \cap \{0, 1, 2\}$$

$$= \{0, 1, 2\} \dots \dots (ii)$$

Hence from (i) and (ii) $A \cap (B \cap C) = (A \cap B) \cap C$

b) Associative property of intersection:

$$A \cap (B \cap C) = (A \cap B) \cap C$$

Take L.H.S. $A \cap (B \cap C)$

$$B \cap C = \{0\} \cap \{0, 1, 2\}$$

$$= \{0\}$$

$$A \cap (B \cap C) = \emptyset \cap \{0\} = \{0\} \dots \dots (i)$$

Take R.H.S. $(A \cap B) \cap C$

$$A \cap B = \emptyset \cap \{0\} = \emptyset$$

$$(A \cap B) \cap C = \emptyset \cap \{0, 1, 2\}$$

$$= \emptyset \dots \dots (ii)$$

Hence from (i) and (ii) $A \cap (B \cap C) = (A \cap B) \cap C$

Q.8: If $A = \{1, 2, 3, 4, 5, 6, 7\}$, $B = \{1, 3, 5\}$, $C = \{2, 4, 6\}$

Solution:

(i) Associative property of union. $A \cup (B \cap C) = (A \cup B) \cap C$

$$B \cap C = \{1, 3, 5\} \cap \{2, 4, 6\}$$

$$\Rightarrow B \cap C = \{1, 2, 3, 4, 5, 6\}$$

$$A \cup (B \cap C) = \{1, 2, 3, 4, 5, 6, 7\} \cup \{1, 2, 3, 4, 5, 6\}$$

$$A \cup (B \cap C) = \{1, 2, 3, 4, 5, 6, 7\} \dots \dots (i)$$

Take R. H. S.

$$A \cup B = \{1, 2, 3, 4, 5, 6, 7\} \cup \{1, 3, 5\}$$

$$= \{1, 2, 3, 4, 5, 6, 7\}$$

$$(A \cup B) \cap C = \{1, 2, 3, 4, 5, 6, 7\} \cap \{2, 4, 6\}$$

$$= \{1, 2, 3, 4, 5, 6, 7\} \dots \dots (ii)$$

From (i) and (ii) it is proved $A \cup (B \cap C) = (A \cup B) \cap C$

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(ii) Associative property of intersection. $A \cap (B \cap C) = (A \cap B) \cap C$

Take L . H . S.

$$B \cap C = \{1, 3, 5\} \cap \{2, 4, 6\}$$

$$\Rightarrow B \cap C = \{ \}$$

$$A \cap (B \cap C) = \{1, 2, 3, 4, 5, 6, 7\} \cap \{ \}$$

$$= \{ \} \dots\dots\dots(i)$$

Take R . H . S.

$$A \cap B = \{1, 2, 3, 4, 5, 6, 7\} \cap \{1, 3, 5\}$$

$$= \{1, 3, 5\}$$

$$(A \cap B) \cap C = \{1, 3, 5\} \cap \{2, 4, 6\}$$

$$= \{ \} \dots\dots\dots(ii)$$

From (i) and (ii) it is proved $A \cap (B \cap C) = (A \cap B) \cap C$

Venn diagram: In Venn diagram the universal set U is represented by a rectangle and other sets are represented by small circles inside the rectangle.

Exercise 8.3:

Q.1: If $A = \{1, 2, 3, 4, 5\}$ and $B = \{4, 5, 6, 7\}$. Then Draw Venn diagram for the following .

(i) $A \cup B$ (ii) $A \cap B$

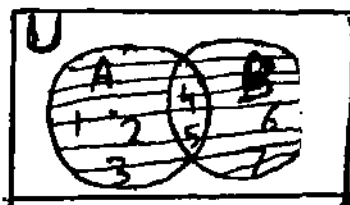
Solution: (i) $A \cup B$

$$A \cup B = \{1, 2, 3, 4, 5\} \cup \{4, 5, 6, 7\}$$

$$= \{1, 2, 3, 4, 5, 6, 7\}$$

The shaded part show $A \cup B$.

Venn diagram $A \cup B$



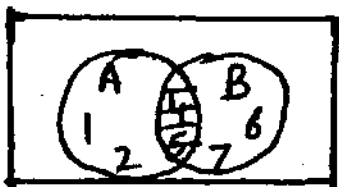
(ii) $A \cap B$

$$A \cap B = \{1, 2, 3, 4, 5\} \cap \{4, 5, 6, 7\}$$

$$= \{4, 5\}$$

The shaded part show $A \cap B$

Venn diagram $A \cap B$



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Q: If

$$A = \{1, 2, 3, 4, 5, 6\}, B = \{3, 4, 5, 6, 7, 8\}$$

and $C = \{5, 6, 9, 10\}$ then with the help of Venn diagram.

(i) $A \cup (B \cap C) = (A \cup B) \cap C$

(ii) $A \cap (B \cap C) = (A \cap B) \cap C$

Solution: $A = \{1, 2, 3, 4, 5, 6\}$, $B = \{3, 4, 5, 6, 7, 8\}$

and $C = \{5, 6, 9, 10\}$

◀ $A \cup (B \cap C) = (A \cup B) \cap C$

Take L. H. S.

$$B \cap C = \{3, 4, 5, 6, 7, 8\} \cap \{5, 6, 9, 10\}$$

$$= \{5, 6\}$$

$$A \cup (B \cap C) = \{1, 2, 3, 4, 5, 6\} \cup \{5, 6\}$$

$$= \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} \dots (i)$$

$$= \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} \dots (i)$$

The shaded part show $A \cup (B \cap C)$

Venn diagram of $A \cup (B \cap C)$

Take R. H. S.

$$A \cup B = \{1, 2, 3, 4, 5, 6\} \cup \{3, 4, 5, 6, 7, 8\}$$

$$= \{1, 2, 3, 4, 5, 6, 7, 8\}$$

$$(A \cup B) \cap C = \{1, 2, 3, 4, 5, 6, 7, 8\} \cap \{5, 6, 9, 10\}$$

$$= \{5, 6\}$$

$$= \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} \dots (ii)$$

The shaded part show $(A \cup B) \cap C$.

Venn diagram $(A \cup B) \cap C$.

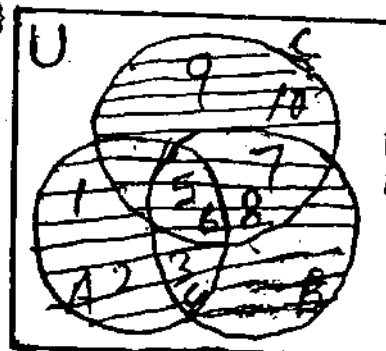
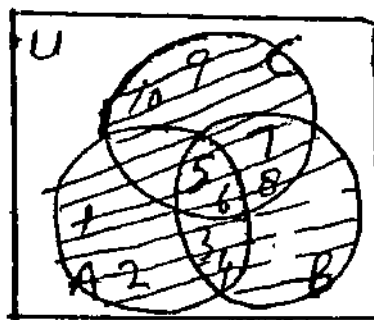
It is clear from figure (i) and (ii) the

parts which shows $A \cup (B \cap C)$ and $(A \cup B) \cap C$ are equal.

Thus $A \cup (B \cap C) = (A \cup B) \cap C$

ii) $A \cap (B \cap C) = (A \cap B) \cap C$

Take L. H. S.



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$$B \cap C = \{3, 4, 5, 6, 7, 8\} \cap \{5, 6, 9, 10\}$$

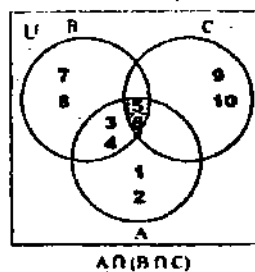
$$= \{5, 6\}$$

$$A \cap (B \cap C) = \{1, 2, 3, 4, 5, 6\} \cap \{5, 6\}$$

$$= \{5, 6\} \dots (i)$$

The shaded part show $A \cap (B \cap C)$

Venn diagram of $A \cap (B \cap C)$



Take R. H. S.

$$A \cap B = \{1, 2, 3, 4, 5, 6\} \cap \{3, 4, 5, 6, 7, 8\}$$

$$= \{3, 4, 5, 6\}$$

$$(A \cap B) \cap C = \{3, 4, 5, 6\} \cap \{5, 6, 9, 10\}$$

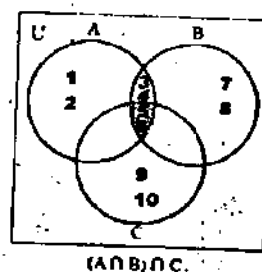
$$= \{5, 6\} \dots (ii)$$

The shaded part show $(A \cap B) \cap C$.

Venn diagram $(A \cap B) \cap C$.

It is clear from figure (i) and (ii) the parts which shows $A \cap (B \cap C)$ and $(A \cap B) \cap C$ are equal.

Thus $A \cap (B \cap C) = (A \cap B) \cap C$



Q.3: If $U = \{1, 2, 3, 4, 5, 6, 7\}$, $A = \{1, 2, 3, 4\}$

And $B = \{3, 4, 5\}$ then draw Venn diagrams for

A' , B' , $A \cup B$ and $A \cap B$ and also verify that

(i) $A \cup B = B \cup A$

(ii) $A \cap B = B \cap A$

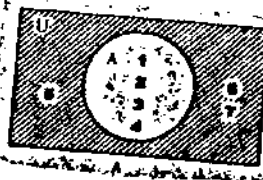
Solution: A'

$$A' = U / A = \{1, 2, 3, 4, 5, 6, 7\} / \{1, 2, 3, 4\}$$

$$= \{5, 6, 7\} \dots (i)$$

The shaded part is show A' .

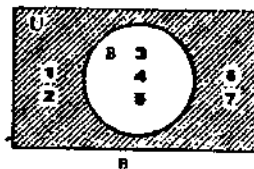
Venn diagram of A'



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B' :

$$B' = U / B = \{1, 2, 3, 4, 5, 6, 7\} / \{3, 4, 5\} \\ = \{1, 2, 6, 7\} \dots (ii)$$



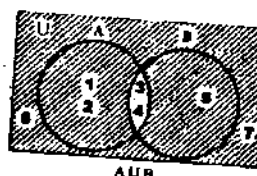
The shaded part show B' .

Venn diagram of B' .

$$A' \cup B': \text{ From (i) } A' = \{5, 6, 7\}$$

$$\text{ From (ii) } B' = \{1, 2, 6, 7\}$$

$$A' \cup B' = \{5, 6, 7\} \cup \{1, 2, 6, 7\} \\ = \{1, 2, 5, 6, 7\}$$

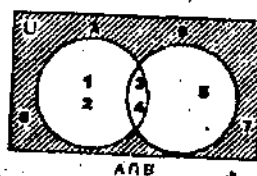


The shaded part show $A' \cup B'$.

Venn diagram of $A' \cup B'$.

$A' \cap B'$:

$$A' \cap B' = \{5, 6, 7\} \cap \{1, 2, 6, 7\} \\ = \{6, 7\}$$



The shaded part show $A' \cap B'$.

Venn diagram of $A' \cap B'$.

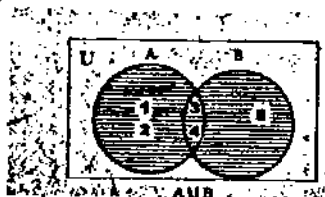
(i)

$$A \cup B = \{1, 2, 3, 4\} \cup \{3, 4, 5\} \\ = \{1, 2, 3, 4, 5\}$$

The shaded part of $A \cup B$.

Venn diagram of $A \cup B$.

$$B \cup A = \{3, 4, 5\} \cup \{1, 2, 3, 4\} \\ = \{1, 2, 3, 4, 5\}$$



The shaded part of $A \cup B$.

Venn diagram of $A \cup B$.

It is clear from figure (i) and (ii) the parts which shows $A \cap B$ and $B \cap A$ which are equal.



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(ii)

$$A \cap B = \{1, 2, 3, 4, 5, 6, 7\} \cap \{3, 4, 5\} \\ = \{3, 4, 5\} \dots (i)$$

The shaded part of $A \cap B$.

Venn diagram of $A \cap B$.

$$B \cap A = \{3, 4, 5\} \cap \{1, 2, 3, 4, 5, 6, 7\} \\ = \{3, 4, 5\} \dots (ii)$$

The shaded part of $A \cap B$.

Venn diagram of $A \cap B$.

It is clear from figure (i) and (ii)

the parts which shows $A \cap B$ and $B \cap A$ which are equal.

Q.4: If $U = \{a, b, c, 1, 2, 3, 4\}$, $A = \{c, 3\}$ and $B = \{a, 3, 4\}$.

Then draw Venn diagrams of A' , B' , A/B and B/A .

Solution: A'

$$A' = U / A = \{a, b, c, 1, 2, 3, 4\} / \{c, 3\} \\ = \{a, b, 1, 2, 4\}$$

The shaded part is show A' .

Venn diagram of A'

B' :

$$B' = U - B = \{a, b, c, 1, 2, 3, 4\} / \{a, 3, 4\} \\ = \{b, c, 1, 2\}$$

The shaded part show B' .

Venn diagram of B' .

A/B :

$$A/B = \{c, 3\} / \{a, 3, 4\} = \{c\}$$

The shaded part show A/B .

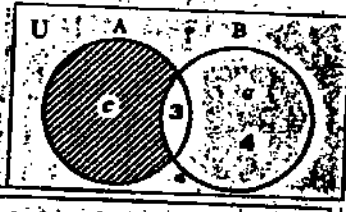
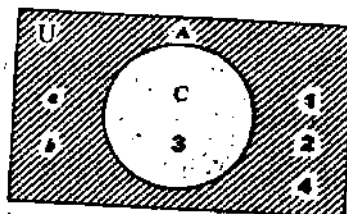
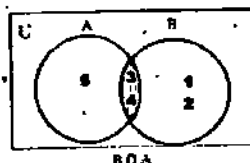
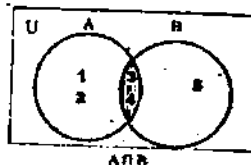
Venn diagram of A/B .

B/A :

$$B/A = \{a, 3, 4\} / \{c, 3\} = \{a\}$$

The shaded part show B/A .

Venn diagram of B/A .



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Q.5: If

$$U = \{a, b, c, d, e, f, g, h\}, A = \{a, b, c\} \text{ and}$$

$B = \{c, d, e\}$ then verify De- Morgan's laws with the help of Venn diagrams.

Solution: $U = \{a, b, c, d, e, f, g, h\}, A = \{a, b, c\}$

$$B = \{c, d, e\}$$

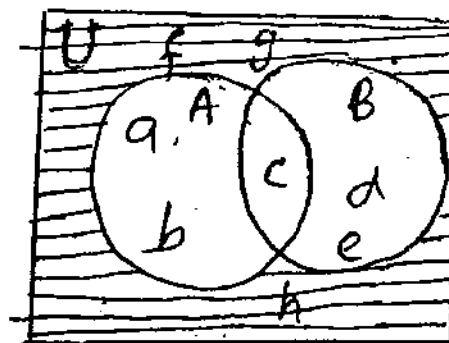
(a) $(A \cup B)' = A' \cap B'$

Take L.H.S.

$$\begin{aligned} A \cup B &= \{a, b, c\} \cup \{c, d, e\} \\ &= \{a, b, c, d, e\} \end{aligned}$$

$$(A \cup B)' = U / A \cup B$$

$$\begin{aligned} &= \{a, b, c, d, e, f, g, h\} \\ &\quad / \{a, b, c, d, e\} \\ &= \{f, g, h\} \dots \dots (i) \end{aligned}$$



The shaded part show $(A \cup B)'$

Venn diagram of $(A \cup B)'$.

Take R.H.S.

$$\begin{aligned} A' &= U / A = \{a, b, c, d, e, f, g, h\} / \{a, b, c\} \\ &= \{d, e, f, g, h\} \end{aligned}$$

$$\begin{aligned} B' &= U / B = \{a, b, c, d, e, f, g, h\} / \{c, d, e\} \\ &= \{a, b, f, g, h\} \end{aligned}$$

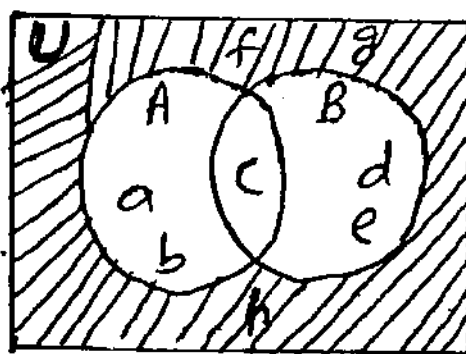
$$\begin{aligned} A' \cap B' &= \{d, e, f, g, h\} \\ &\quad \cap \{a, b, f, g, h\} \\ &= \{f, g, h\} \dots \dots (ii) \end{aligned}$$

The shaded part show $A' \cap B'$.

Venn diagram of $A' \cap B'$.

It is clear from figure (i) and (ii) the parts which shows

$(A \cup B)'$ and $A' \cap B'$ which are equal.



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i) $(A \cap B)' = A' \cup B'$. Take L . H . S.

$A \cap B = \{a, b, c\} \cap \{c, d, e\} = \{c\}$

$(A \cap B)' = U / A \cap B$
 $= \{a, b, c, d, e, f, g, h\} / \{c\}$
 $= \{a, b, d, f, e, g, h\} \dots \dots (i)$

The shaded part show $(A \cap B)'$

Venn diagram of $(A \cap B)'$.

Take R . H . S.

$A' = U / A = \{a, b, c, d, e, f, g, h\} / \{a, b, c\}$
 $= \{d, e, f, g, h\}$

$B' = U / B = \{a, b, c, d, e, f, g, h\} / \{c, d, e\}$
 $= \{a, b, f, g, h\}$

$A' \cup B' = \{d, e, f, g, h\} \cup \{a, b, f, g, h\}$
 $= \{a, b, d, e, f, g, h\} \dots \dots (ii)$

The shaded part show $A' \cup B'$.

Venn diagram of $A' \cup B'$

It is clear from figure (i) and (ii) the parts which shows

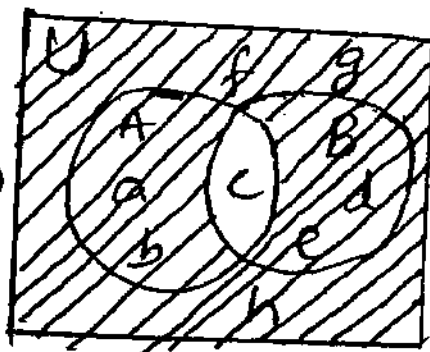
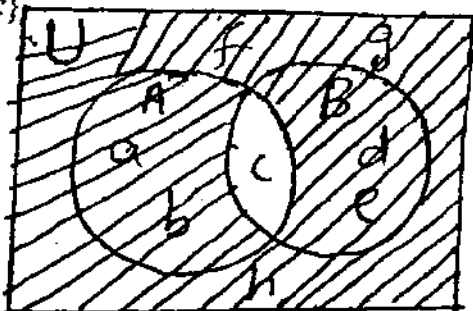
$(A \cap B)'$ and $A' \cup B'$ which are equal .

Thus $(A \cap B)' = A' \cup B'$.

Ordered pair: (a, b) is called ordered pair in which "a" is the first element and "b" is the second element .

The two ordered pairs (a, b) and (c, d) are only equal if
 $a = c$ and $b = d$.

Cartesian product: Let "A" and "B" are non empty sets then $A \times B$ is called Cartesian product and the elements of $A \times B$ are in ordered pairs in which the first element of each ordered pair belong to A and second element belong to set B .



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symbolically we write

$$A \times B = \{(a, b) / a \in A \wedge b \in B\}$$

Binary relation: If A and B are any two non empty sets then any subset of $A \times B$ is called Binary relation.

Note: If set A has m elements and set B has n elements then

The number of elements of $A \times B$ is mn and the number

Subsets of $A \times B$ are 2^{mn} .

Domain and range of binary relation: If R is a binary relation from set A to set B then the set which contains the first elements of all ordered pairs in R is called Domain. While the set which contains the second elements of all ordered pairs in R is called Range.

Exercise 8.4:

Q.1: If $A = \{1, 2\}$, $B = \{3, 4, 5\}$. Then

(i) Write 3 binary relations from A to B.

(ii) Write 4 binary relations from B to A.

(iii) Write 4 binary relations in A.

(iv) Write 2 binary relations in B.

Solution: $A = \{1, 2\}$, $B = \{3, 4, 5\}$

(i) $A \times B = \{(1, 3), (1, 4), (1, 5), (2, 3), (2, 4), (2, 5)\}$

Since any subset of $A \times B$ is called binary relation.

Then any 3 binary relations from A to B are

$$R_1 = \{(1, 4)\}, R_2 = \{(1, 4), (2, 5)\}$$

$$R_3 = \{(2, 4)\}$$

(ii) $B \times A = \{(3, 1), (3, 2), (4, 1), (4, 2), (5, 1), (5, 2)\}$

Then any 4 binary relations from B to A are

$$R_1 = \{(3, 1)\}, R_2 = \{(3, 2)\}$$

$$R_3 = \{(4, 1), (4, 2)\}, R_4 = \{(5, 1)\}$$

(iii) $A \times A = \{(1, 1), (1, 2), (2, 1), (2, 2)\}$

Then any 4 binary relations from A to A are

$$R_1 = \{(1, 1), (1, 2)\}, R_2 = \{(2, 1)\}$$

$$R_3 = \{(1, 2)\}, R_4 = \{(1, 2), (2, 1)\}$$

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$$(iv) B \times B = \left\{ (3,3), (3,4), (3,5), (4,3), (4,4), (4,5), (5,3), (5,4), (5,5) \right\}$$

Then any 2 binary relations from B to B are

$$R_1 = \{(3,3)\}, \quad R_2 = \{(4,5), (5,5)\}$$

Q.2: If $A = \{1, 2, 3, 4\}$, $B = \{1, 3, 5\}$ and

$R = \{(x, y) / y < x\}$ is a binary relation from A to B, then write in tabular form.

Solution: $A = \{1, 2, 3, 4\}$, $B = \{1, 3, 5\}$

$$R = \{(x, y) / y < x\} \dots\dots(i)$$

$$A \times B = \left\{ (1,1), (1,3), (1,5), (2,1), (2,3), (2,5), (3,1), (3,3), (3,5), (4,1), (4,3), (4,5) \right\}$$

Then relation (i) in tabular form is

$$R = \{(2,1), (3,1), (4,1), (4,3)\}$$

Q.3: Domain of a binary relation $R = \{(x, y) / y = 2x\}$ in set

W is $\{0, 4, 8\}$. Find range.

Solution: $R = \{(x, y) / y = 2x\}$

$$y = 2x \dots\dots(i)$$

$$\text{Put } x = 0 \text{ in (i)} \quad y = 2(0) = 0$$

$$\text{Put } x = 4 \text{ in (i)} \quad y = 2(4) = 8$$

$$\text{Put } x = 8 \text{ in (i)} \quad y = 2(8) = 16$$

Thus range is $\{0, 8, 16\}$.

Q.4: Domain of a binary relation $R = \{(x, y) / y + 1 = 2x^2\}$ is set N. Find its range.

Solution: $R = \{(x, y) / y + 1 = 2x^2\} \dots\dots(i)$

$$y + 1 = 2x^2$$

$$\Rightarrow y = 2x^2 - 1 \dots\dots(i)$$

Since N is domain of R. Then

Put $x = 1$ in (i)

$$y = 2(1)^2 - 1 = 2 - 1 = 1$$

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Put $x = 2$ in (i)

$$y = 2(2)^2 - 1 = 2(4) - 1$$

$$= 8 - 1 = 7$$

Put $x = 3$ in (i)

$$y = 2(3)^2 - 1 = 2(9) - 1$$

$$\Rightarrow y = 18 - 1 = 17$$

And so on .

Thus range of R is $\{1, 7, 17, \dots\}$.

Function: Let A and B are two non empty sets then a binary relation f from A to B is called function if f contains those ordered pairs whose first elements are all distinct and domain set is equal to set A

OR

Let A and B are two non empty sets then a binary relation f from A to B is called function if

(i) Domain $f = A$

(ii) There should be no repetition in the first element of all ordered pairs contained in f. Symbolically we write

$$f : A \longrightarrow B$$

Kinds of function: (i) **Into function:** Let f be a function from A to B, then f is into function if $\text{Range of } f \neq B$

(ii) **One – one or (1 – 1) function:** A function f from A to B is called one – one if there is no repetition in the second element of all ordered pairs contained in f. i.e. Distinct elements of set A mapped to distinct elements of set B.

(iii) **Into and one – one function (Injective):**

Let f be a function from A to B, then f is called into and one – one function if

(i) $\text{Range } f \neq B$

(iv) **Onto function:** Let f be a function from A to B, then f is called onto function if every element of set B is the image of some elements of set A. or

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Range $f = B$.

(v) **one –one and onto function:** A function f from set A to set B which is one –one and onto is called bijective function.

One – one correspondence: If A and B are two non empty Sets then a rule for which each element of a set A is Paired with one and only one element of set B and each element of a set B is Paired with one and only one element of set A . Then it is called one –one correspondence

Exercise 8.5:

Q.1: $A = \{1, 2, 3, 4\}$ and $B = \{6, 7\}$ and the following are relations from A to B , then state whether these are functions or not? . If these are functions then state which kind of functions are they ? .

$$R_1 = \{(1, 6), (2, 7), (3, 6)\}$$

$$R_2 = \{(1, 6), (2, 6), (3, 7), (4, 7)\}$$

$$R_3 = \{(1, 6), (2, 6), (3, 6), (4, 6)\}$$

Solution: (i) $R_1 = \{(1, 6), (2, 7), (3, 6)\}$ it is not a function

Because Domain $R_1 = \{1, 2, 3\}$. Since

$$\text{Domain } R_1 = \{1, 2, 3\} \neq A$$

(ii) $R_2 = \{(1, 6), (2, 6), (3, 7), (4, 7)\}$

It is a function . it is onto. Because-

$$\text{Range } R_2 = \{6, 7\} = B$$

(iii) $R_3 = \{(1, 6), (2, 6), (3, 6), (4, 6)\}$

It is into function because $\text{Range } R_3 = \{6\} \neq B$

Q.2: Which of the following relations on set $A = \{a, b, c, d\}$

are functions ? State the kind of functions as well ?

(i) $\{(a, b), (c, d), (b, d), (d, a)\}$

(ii) $\{(b, a), (c, d), (b, d), (d, b)\}$

(iii) $\{(d, c), (c, b), (a, b), (d, d)\}$

(iv) $\{(a, b), (b, c), (c, b), (d, a)\}$

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Solution:

(i) $\{(a, b), (c, d), (b, d), (d, a)\}$

It is into function. Because domain set $\{a, c, b, d\}$ is equal to set A and range set $\{a, b, d\}$ is not equal to set A.

(ii) $\{(b, a), (c, d), (b, d), (d, b)\}$

It is not a function because Domain set $\{b, c, d\}$ is not equal to set A.

(iii) $\{(d, c), (c, b), (a, b), (d, d)\}$

It is not a function because Domain set $\{d, c, a\}$ is not equal to set A.

(iv) $\{(a, b), (b, c), (c, b), (d, a)\}$

It is into function. Because domain set $\{a, b, c, d\}$ is equal to set A and range set $\{b, c, a\}$ is not equal to set A.

Q.3: If $A = \{0, 1, 2, 3\}$ and $B = \{x, y, z, p\}$ then write
 write three functions from A to B such that two
 functions of them are 1 – 1 as well as onto.

Solution: (i) $f_1 = \{(0, x), (2, z), (3, y), (1, p)\}$

There is one – one correspondence because each element of a set A is Paired with one and only one element of set B and each element of a set B is Paired with one and only one element of set A. So it is 1 – 1 and onto.

(ii) $f_2 = \{(0, x), (1, z), (2, y), (3, p)\}$

It is 1 – 1 and onto.

(iii) $f_3 = \{(0, x), (1, x), (2, y), (3, z)\}$

It is neither 1 – 1 nor onto.

Q.4: If $X = \{1, 2, 3, 4\}$ and $Y = \{5, 6, 7, 8\}$ then write,

- (i) A function from X to Y.
- (ii) A one – one function from X to Y.
- (iii) A function which is onto from Y to X.
- (iv) A function which is one – one and onto from X to Y.
- (v) A function which is one – one and onto from Y to X.
- (vi) A function from X to Y which is neither one – one nor onto.

Solution: $X = \{1, 2, 3, 4\}$ and $Y = \{5, 6, 7, 8\}$

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(i) $R_1 = \{(1, 5), (2, 6), (3, 6), (4, 7)\}$

is a function from X to Y.

(ii) $R_2 = \{(1, 5), (2, 6), (3, 7), (4, 8)\}$

is a one - one function.

(iii) $R_4 = \{(6, 1), (5, 2), (7, 3), (8, 4)\}$

It is a function which is onto from Y to X.

(iv) $R_3 = \{(1, 6), (2, 5), (3, 7), (4, 8)\}$

It is one - one and onto function from X to Y.

(v) $R_5 = \{(5, 1), (6, 2), (7, 3), (8, 4)\}$

It is function which is one - one and onto from Y to X.

(vi) $R_6 = \{(1, 5), (2, 5), (3, 6), (4, 6)\}$

It is a function from X to Y which is neither one - one nor onto.

Exercise 8.6 (Objective type questions):

Q.1: True and False.

Read the following statement carefully and encircle "T" in case of true statement and "F" in case of false statement.

- (i) If $A \subseteq B$ then $A \cup B = A$ T - F
- (ii) If $A \subseteq B$ then $A \cap B = A$ T - F
- (iii) $\{(1, 2), (3, 4), (5, 6)\}$ has domain $\{1, 3\}$ T - F
- (iv) The set $\{1, 2, 3, \dots\}$ is a set of whole number T - F
- (v) Complement of an empty set is an empty set. T - F
- (vi) The union of two sets A and B is denoted by $A \cup B$ T - F
- (vii) $\{(1, 4), (2, 8), (3, 12)\}$ has range $\{1, 2, 3\}$ T - F
- (viii) if f is a function from A to B and range $f \subseteq B$ then f is said to be into function. T - F
- (ix) $\{(1, 2), (3, 4), (5, 6)\}$ has domain $\{1, 3, 5\}$ T - F

Answers: (i) F (ii) T (iii) F (iv) F (v) F (vi) T
 (vii) F (viii) T (ix) T

Q.2: Fill in the blanks.

- (i) $\{2, 4, 6, 8\}$ is the set of first fournumbers.

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- (ii) The set of integers is represented by
- (iii) $A \cup A' = \dots\dots\dots$
- (iv) $A \cap A' = \dots\dots\dots$
- (v) If A and B are two sets then $A/B = \dots\dots\dots$
- (vi) $A \cup (B \cap C) = \dots\dots\dots$
- (vii) $(A \cup B)' = \dots\dots\dots$
- (viii) If a set has no elements then it is called
- (ix) If $A = \{1, 2, 3\}$ and $B = \{4, 5, 6\}$ Then the number of elements in $A \times B = \dots\dots\dots$

Answers: (i) Positive even (ii) Z (iii) U (iv) { }
 (v) $\{x/x \in A \wedge x \notin B\}$ (vi) $(A \cup B) \cap C$
 (vii) $A' \cap B'$ (viii) Empty set (ix) 9 .

Q.3: Write the correct option against the given box.

- (i) The set $\{0, \pm 1, \pm 2, \pm 3, \dots\dots\dots\}$ is
 (a) set of natural numbers (b) Set of whole numbers
 (c) Set of prime numbers (d) Set of integers
- (ii) If $R = \{(a, 1), (b, 2), (c, 3)\}$ then Domain R =
 (a) $\{1, 2\}$ (b) $\{1, 2, 3\}$ (c) $\{a, b, c\}$ (d) $\{a, c\}$
- (iii) if $B = \{1, 2, 100\}$ and $C = \{2, 200\}$, then $B \cap C = \dots\dots\dots$
 (a) $\{1, 2\}$ (b) $\{1, 2, 100, 200\}$ (c) $\{2\}$ (d) $\{2, 1\}$
- (iv) If $A = \{0, 1, 2\}$, $B = \{2, 3, 4, 5\}$, Then $A \cup B = \dots\dots\dots$
 (a) $\{2\}$ (b) $\{0, 1, 2, 4\}$ (c) $\{0, 1, 2, 3, 4, 5\}$ (d) $\{2, 3, 4\}$
- (v) If $A = \{1, 2, 3\}$, $B = \{4, 5\}$ and $R = \{(1, 4), (2, 5), (3, 4)\}$
 then R, is
 (a) one -one function from A to B.
 (b) A function from A to A .
 (c) not a function (d) A onto function from A to B.
- (vi) If $A \cup B = \emptyset$ then A and B are
 (a) empty sets (b) equal sets (c) overlapping sets
 (d) disjoint sets
- (vii) $A \cup A' = \dots\dots\dots$

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- (a) U (b) A (c) A' (d) ϕ
- (viii) $U' = \dots\dots\dots$
 (a) U' (b) ϕ (c) U (d) A
- (ix) $\left\{x \mid x = \frac{p}{q}, q \neq 0, p, q \in \mathbb{Z}\right\}$ then this is a
 (a) set of even number (b) set of rational number
 (c) set of irrational number (d) set of integers.
- (x) If A has two elements and B has 3 elements, then number of binary relations in $A \times B$.
 (a) 2×3 (b) 2^3 (c) 2^6 (d) 2^2
- (xi) $(A \cap B)' = \dots\dots\dots$
 (a) $A' \cup B'$ (b) $A' \cap B'$ (c) $A \cup B$ (d) $A' \cup B$
- (xii) $A' = \dots\dots\dots$
 (a) $\{x \mid x \in U \wedge x \notin A\}$ (b) $\{x \mid x \in U \wedge x \in A\}$
 (c) $\{x \mid x \notin U \wedge x \in A\}$ (d) $\{x \mid x \in U \wedge x \notin A'\}$
- (xiii) $A \cup B$ in set builder notation is
 (a) $\{x \mid x \in A \wedge x \notin B\}$ (b) $\{x \mid x \in A \wedge x \in B\}$
 (c) $\{x \mid x \in A \text{ or } x \in B\}$ (d) non of these
- (xiv) If $R = \{(0, 0), (8, 2), (10, 3), (14, 12)\}$, then $\text{Dom } R = \dots\dots$
 (a) $\{0, 8, 10, 14\}$ (b) $\{0, 2, 3, 12\}$
 (c) $\{8, 10, 4\}$ (d) $\{0, 10\}$
- (xv) If f is a function from A to B , then f is onto function if
 (a) $\text{Range } f \neq B$ (b) $\text{Range } f = B$
 (c) $\text{Dom } f = A$
 (d) second element of all ordered pairs in f is not repeated.
- Answers:** (i) d (ii) c (iii) c (iv) c (v) d (vi) a (vii) a
 (viii) b (ix) b (x) c (xi) a (xii) a (xiii) c (xiv) a
 (xv) b

UNIT - 9.

Linear Graphs and their application.

Cartesian plane:

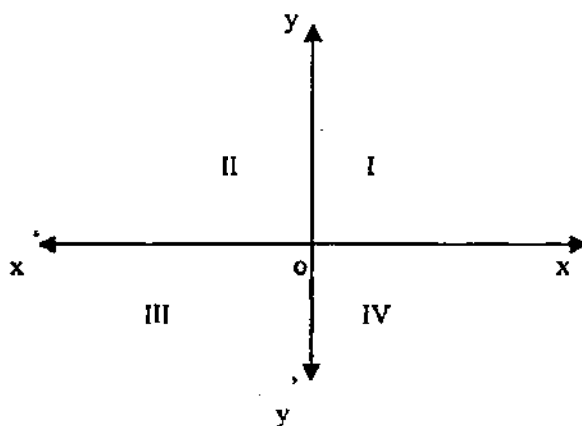
When two number lines one vertical and other Horizontal intersect each other at point "O" then we get four equal parts then each part is called quadrant. The horizontal line is called x-axis and vertical line is called y-axis. The point "O" is called origin. The ordered pair (x, y) in which x represent in x-axis and y represent along y-axis.

Note: In the first quadrant $x > 0$ and $y > 0$

In the second quadrant $x < 0$ and $y > 0$

In the third quadrant $x < 0$ and $y < 0$

In the fourth quadrant $x > 0$ and $y < 0$



Exercise 9.1.

Q.1: Determine the x and y coordinates of the following points.

- (i) A(-3, 4) (ii) B(6, 0) (iii) C(3, 7)
(iv) D(-2, -3) (v) E(1, 2)

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Solution: (i) $A(-3, 4)$

Then $x = -3$ and $y = 4$

(ii) $B(6, 0)$

Then $x = 6$, $y = 0$

(iii) $C(3, 7)$

Then $x = 3$, $y = 7$

(iv) $D(-2, -3)$

Then $x = -2$, $y = -3$

(v) $E(1, 2)$

Then $x = 1$, $y = 2$

Q.2: Mention the quadrant in which each of the
 Following point lies.

(i) $A(\sqrt{2}, -1)$ (ii) $B(3, -2)$ (iii) $C(2, 2)$

(iv) $D(-4, -5)$ (v) $E(-\sqrt{3}, \sqrt{5})$

Solution: (i) $A(\sqrt{2}, -1)$

$\Rightarrow x = \sqrt{2}$, $y = -1$

Thus $A(\sqrt{2}, -1)$ is in the fourth quadrant.

(ii) $B(3, -2)$: *Then*

$x = 3$, $y = -2$

Thus $B(3, -2)$ lies in the fourth quadrant.

(iii) $C(2, 2)$: *Then*

$x = 2$, $y = 2$

Thus $C(2, 2)$ is in the first quadrant.

(iv) $D(-4, -5)$: *Then*

$x = -4$, $y = -5$

Thus $D(-4, -5)$ is in the third quadrant.

(v) $E(-\sqrt{3}, \sqrt{5})$: *Then*

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$$x = -\sqrt{3} \quad y = \sqrt{5}$$

Thus $E(-\sqrt{3}, \sqrt{5})$ is in the second quadrant.

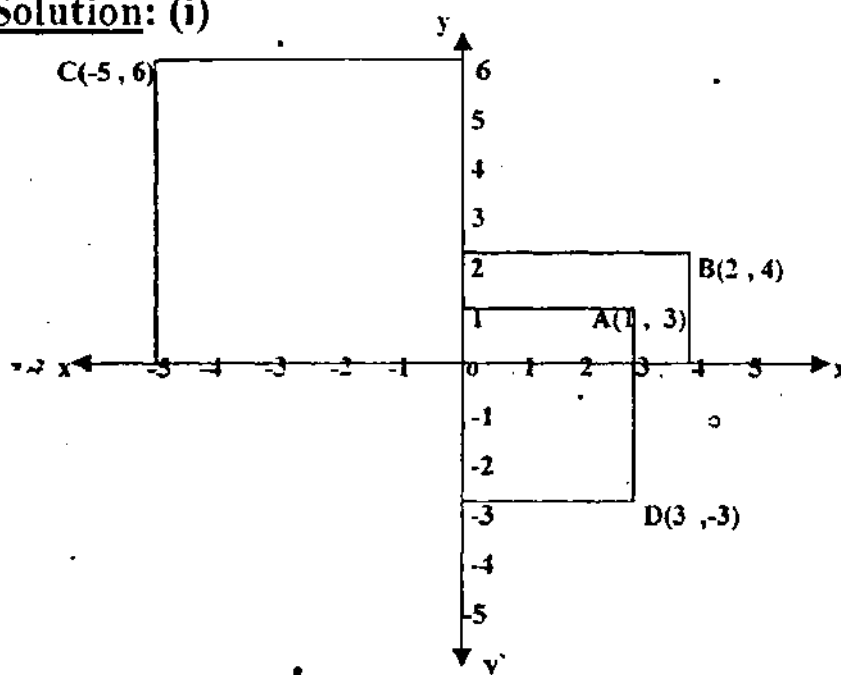
Q.3: Plot the points A , B , C and D on the xy – plane in each of the following .

(i) $A(3, 1)$, $B(2, 4)$, $C(-5, 6)$, $D(3, -3)$

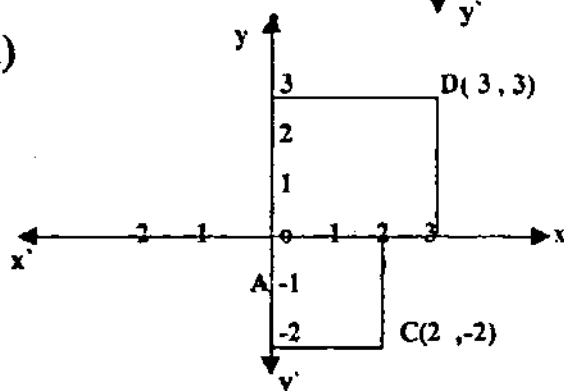
(ii) $A(-1, 0)$, $B(0, -1)$, $C(2, -2)$, $D(3, 3)$

(iii) $A(4, 4)$, $B(0, 0)$, $C(8, -6)$, $D(-7, 5)$

Solution: (i)

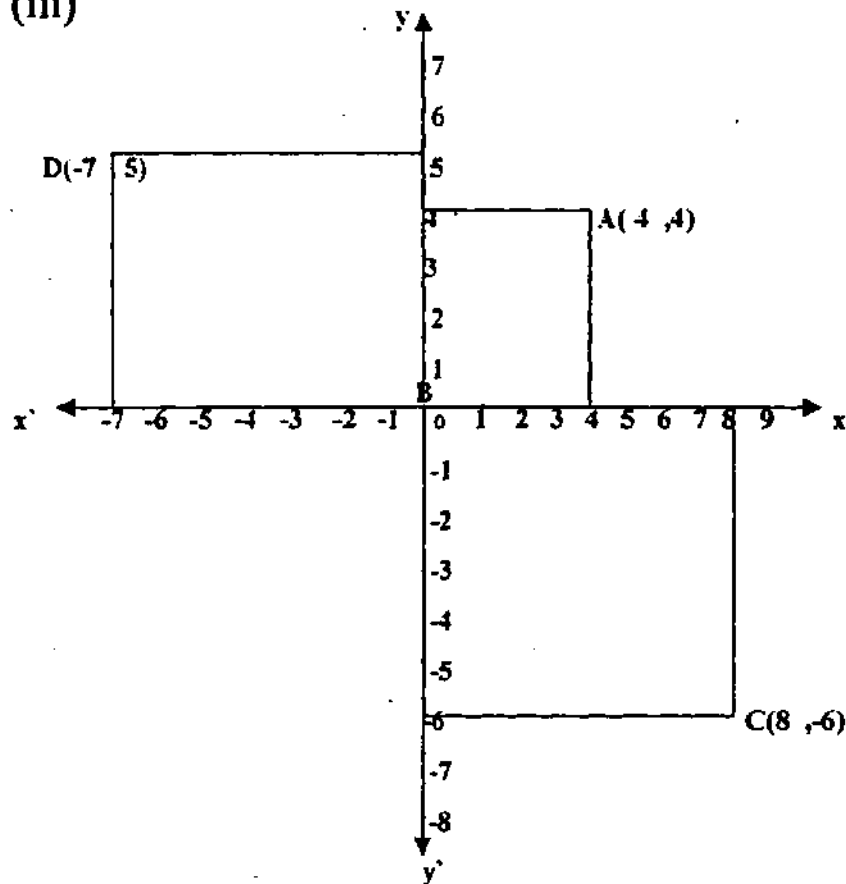


(ii)

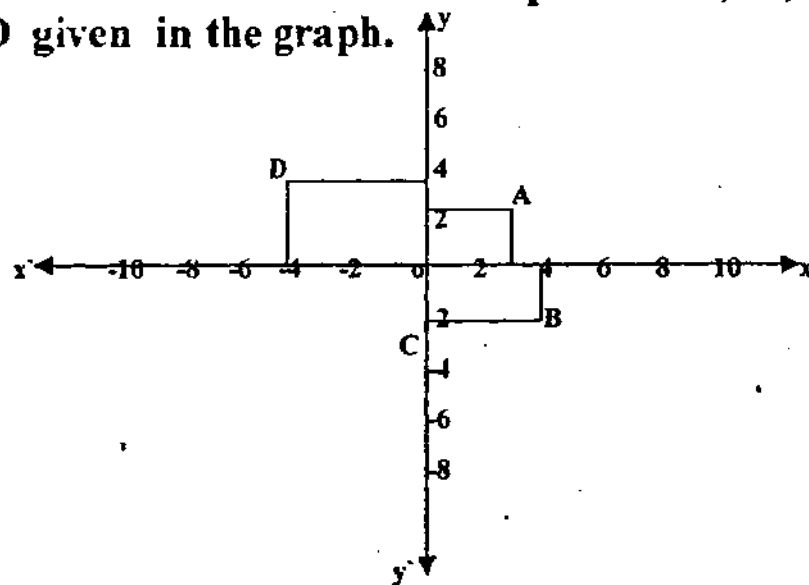


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(iii)



Q.4: Write the coordinates of the points A , B , C and D given in the graph.



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Solution: From the graph the coordinates of points

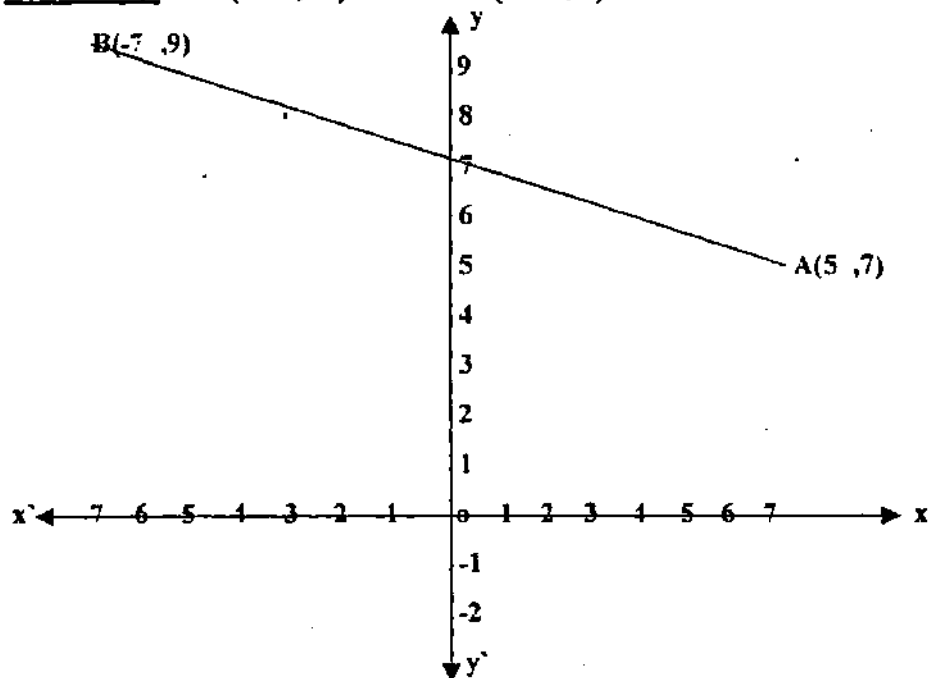
A, B, C and D are

$A(3, 2)$, $B(4, -2)$, $C(0, -3)$, $D(-4, 4)$.

Q.5: Draw a line segment \overline{AB} joining by the points

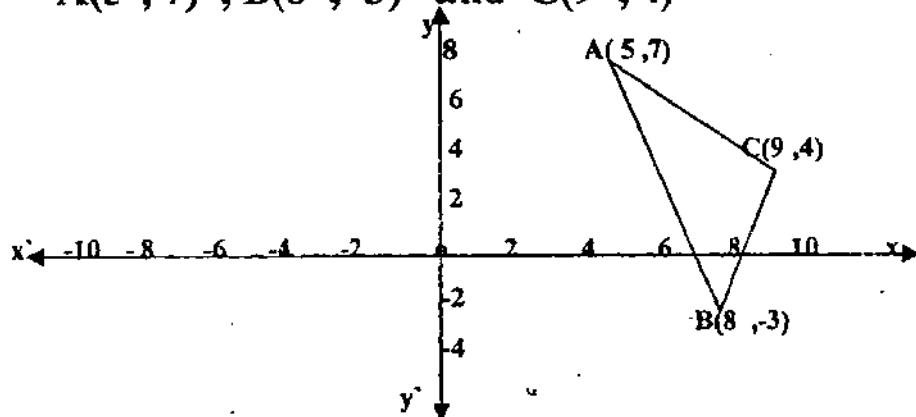
$A(5, 7)$ and $B(-7, 9)$.

Solution: $A(5, 7)$ and $B(-7, 9)$



Q.6: Draw a triangle ABC by joining the points

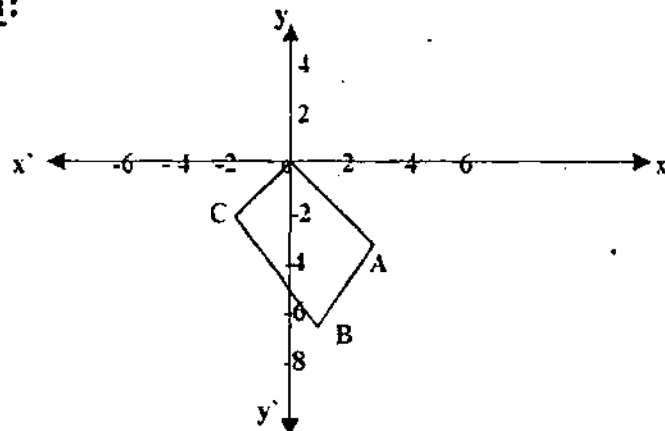
$A(5, 7)$, $B(8, -3)$ and $C(9, 4)$



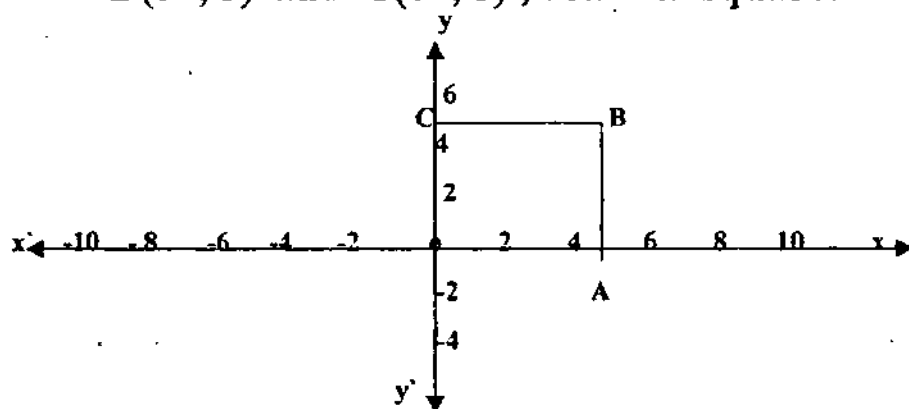
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Q.7: Draw a parallelogram OABC by joining the Points O(0 , 0) , A(3 , -4) , B(1 , -7) and C(-2 , -3).

Solution:



Q.8: By joining points O(0 , 0) , A(5 , 0) , B(5 , 5) and C(0 , 5) , draw a square.



Q.9: Show that points A(0 , 1) , B(1 , 2) , C(2 , 1) and D(1 , 0) are the vertices square.

Solution: Use distance formula

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \dots\dots\dots(i) \quad \text{Now}$$

put A(0 , 1) and B(1 , 2) in (i)

$$|AB| = \sqrt{(1-0)^2 + (2-1)^2} = \sqrt{1+1} = \sqrt{2}$$

Put B(1 , 2) and C(2 , 1) in (i)

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$$|BC| = \sqrt{(2-1)^2 + (1-2)^2} = \sqrt{1+1} = \sqrt{2}$$

Put $C(2, 1)$ & $D(1, 0)$ in (i)

$$|CD| = \sqrt{(1-2)^2 + (0-1)^2} = \sqrt{(-1)^2 + (-1)^2}$$

$$\Rightarrow |CD| = \sqrt{1+1} = \sqrt{2}$$

put $A(0, 1)$ & $D(1, 0)$ in (i)

$$|AD| = \sqrt{(1-0)^2 + (0-1)^2} = \sqrt{1+1} = \sqrt{2}$$

$$\text{As } |AB| = |BC| = |CD| = |AD|$$

Thus ABCD is a square.

Graph of linear equation : $ax + by = c$ is called linear equation in two variables. Where a, b, c are constants and x, y are variables.

Solution of this equation is the set of ordered pairs Which satisfied the given equation.

The graph of linear equation is a straight which includes the set of points representing the ordered pairs of the solution set.

Exercise 9.2.

Q.1: Determine whether or not each of the following ordered pairs are solutions to the linear equations given :

(a) $(0, -2)$, $3x - 2y = 4$ (b) $(1, 3)$, $2x + y = 6$

(c) $(2, 0)$, $x - y = 2$

Solution: (a) $3x - 2y = 4$ (i) and $(0, -2)$

put $x = 0$, $y = -2$ in (i)

$$3(0) - 2(-2) = 4$$

$$\Rightarrow 4 = 4 \text{ Hence L.H.S.} = \text{R.H.S.}$$

Thus the point $(0, -2)$ is solution of (i).

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(b) $2x + y = 6$ (i) and (1,3)

put $x = 1$, $y = 3$ in (i)

$$2(1) + 3 = 6$$

$$\Rightarrow 2 + 3 = 6$$

$$\Rightarrow 5 \neq 6$$

Thus the point (1, 3) is not the solution of (i).

(c) $x - y = 2$ (i) and (2, 0)

put $x = 2$ and $y = 0$ in (i)

$$2 - 0 = 2$$

$$\Rightarrow 2 = 2$$

Thus (2, 0) is the solution of (i).

**Q.2: Construct a table for four of values
 Satisfying the equation $x + y = 4$.**

Solution: Given $x + y = 4$

$$\Rightarrow y = 4 - x$$
(i)

put $x = -1$ in (i)

$$y = 4 - (-1) = 4 + 1 = 5$$

put $x = 0$ in (i)

$$y = 4 - 0 = 4$$

put $x = 1$ in (i)

$$y = 4 - 1 = 3$$

put $x = 2$ in (i)

$$y = 4 - 2 = 2$$

Thus the table is

x	-1	0	1	2
$y = 4 - x$	5	4	3	2

Q.3: Draw the graph of the equation $x + 2y = 6$

Solution: Given $x + 2y = 6$

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$$2y = 6 - x$$

$$\Rightarrow y = \frac{6-x}{2} \dots\dots(i)$$

put $x = -2$ in (i)

$$y = \frac{6-(-2)}{2} = \frac{6+2}{2}$$

$$\Rightarrow y = \frac{8}{2} = 4$$

put $x = 0$ in (i)

$$y = \frac{6-0}{2} = \frac{6}{2} = 3$$

put $x = 2$ in (i)

$$y = \frac{6-2}{2} = \frac{4}{2} = 2$$

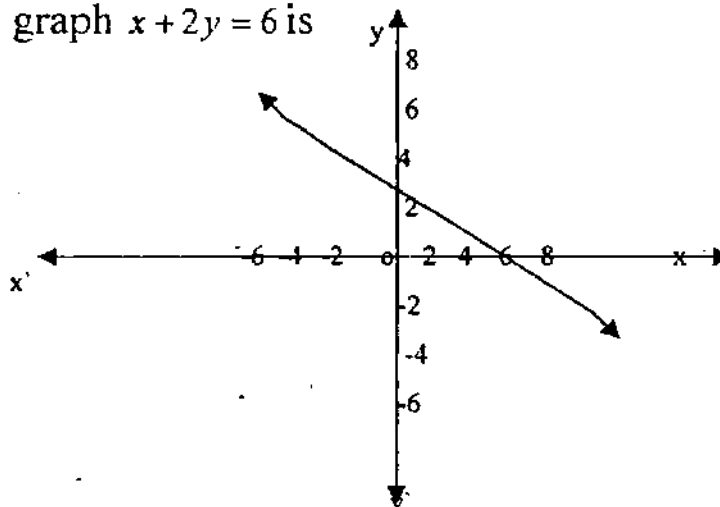
put $x = 4$ in (i)

$$y = \frac{6-4}{2} = \frac{2}{2} = 1$$

The table is under

x	-2	0	2	4
y	4	3	2	1

Now the graph $x + 2y = 6$ is

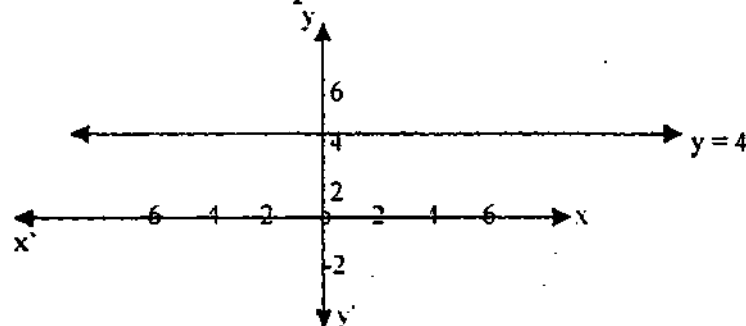


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Q.4: Graph the equation $y = 4$

Solution: Given $y = 4$

Since y is constant and the graph of y intercept y -axis at 4 and parallel to x -axis.



Q.5: Find the missing coordinate in the ordered Pairs, which are solutions to the following equations.

(i) $y = -\frac{1}{3}x$, (6 ,) , (, 0)

(ii) $x - 3y = 14$, (-2 ,) , (, -10)

(iii) $y = 8x - 4$, (-1 ,) , (3 ,)

(iv) $3x + 6y = 18$ (, 3) , (-2 ,)

Solution: (i) $y = -\frac{1}{3}x$ (i) and (6 ,) , (, 0)

put $x = 6$ in (i)

$$y = -\frac{1}{3}(6) = -2$$

put $y = 0$ in (i)

$$0 = -\frac{1}{3}x \Rightarrow x = 0$$

Thus $x = 0$, $y = -2$

(ii) $x - 3y = 14$ (i) and , (-2 ,) , (, -10)

put $x = -2$ in (i)

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$$-2 - 3y = 14$$

$$\Rightarrow -3y = 14 + 2$$

$$\Rightarrow y = -\frac{16}{3}$$

$$\text{put } y = -\frac{16}{3} \text{ in (i)}$$

$$x - 3(-\frac{16}{3}) = 14$$

$$\Rightarrow x + 16 = 14$$

$$\Rightarrow x = 14 - 16 = -2$$

$$\text{Thus } x = -2, y = -\frac{16}{3}$$

(iii) $y = 8x - 4$ (i) and $(-1,)$, $(3,)$

$$\text{put } x = -1 \text{ in (i)}$$

$$y = 8(-1) - 4 = -8 - 4$$

$$\Rightarrow y = -12$$

$$\text{put } x = 3 \text{ in (i)}$$

$$y = 8(3) - 4 = 24 - 4$$

$$\Rightarrow y = 20$$

$$\text{Thus } y = -12, y = 20.$$

(iv) $3x + 6y = 18$ (i) and $(, 3)$, $(-2,)$

$$\text{put } y = 3 \text{ in (i)}$$

$$3x + 6(3) = 18$$

$$\Rightarrow 3x + 18 = 18$$

$$\Rightarrow 3x = 18 - 18$$

$$\Rightarrow 3x = 0$$

$$\Rightarrow x = 0$$

$$\text{put } x = -2 \text{ in (i)}$$

$$3(-2) + 6y = 18$$

$$\Rightarrow -6 + 6y = 18$$

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$$\Rightarrow 6y = 18 + 6$$

$$\Rightarrow 6y = 24$$

$$\Rightarrow \frac{6y}{6} = \frac{24}{6}$$

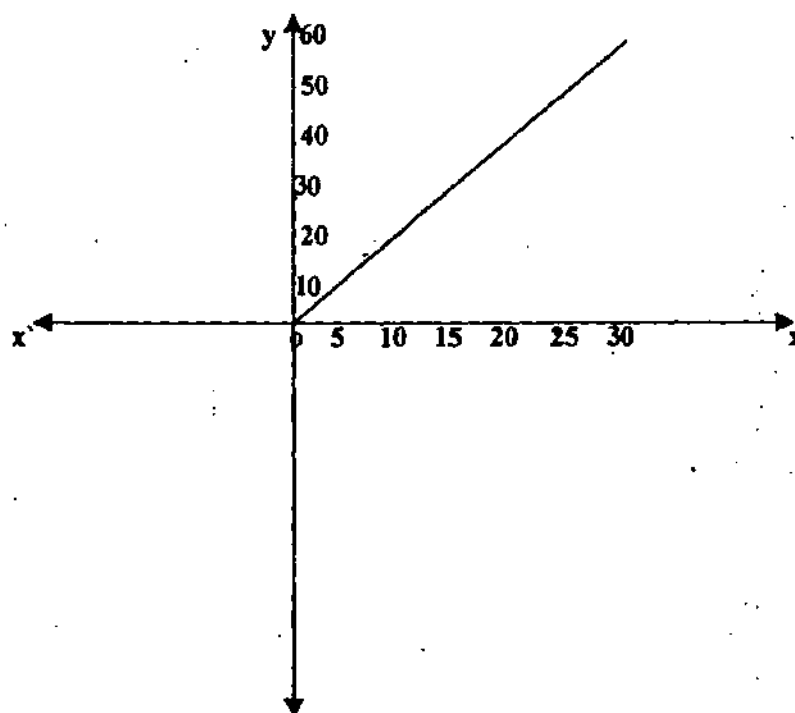
$$\Rightarrow y = 4$$

Thus $x = 0$ and $y = 4$.

Q.6: The weight in kilogram and age in years of a Person is expressed by the equation $y = 2x$, Where \hat{y} (in Kg) and x (in years), Draw the Age-weight graph form the values of the Following table.

x	5	10	15	20	25	30
y	10	20	30	40	50	60

Solution: The graph is under.



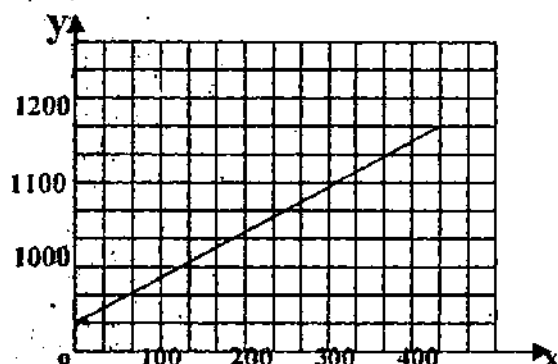
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Q.7: The graph shows the relation between the units of electricity consumed and the total cost of an electricity bill.

- (i) The cost (C) of the bill if 300 units (n) are Consumed.
- (ii) The number of units used when the bill is Rs 1150.



Solution: (i) From the graph

The cost (C) of the bill when 300 units are consumed is Rs. 1090.

- (ii) When cost Rs. 1150 then units are 400.

Q.8: The cost of a domestic telephone consumers is given by the relation $C = n + R$. Where n is units (minutes) consumed R = Rs.170 fixed rent and C is the total cost (in rupees). Construct a table for first 5 minutes at the rate of Rs. 2.5 per minute. Also draw the graph shows the relation of time and cost .

Solution: Given $C = n + R$ (i)

Put $R = 170$, When $n = 0$ in (i)

$$C = 0 + 170 = 170$$

When $n = 1$ then rate 2.5 put in (i)

$$C = 1(2.5) + 170 = 172.5$$

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When $n = 2$ then put in (i)

$$C = 2(2.5) + 170 = 5 + 170 = 175$$

When $n = 3$ then put in (i).

$$C = 3(2.5) + 170 = 7.5 + 170 = 177.5$$

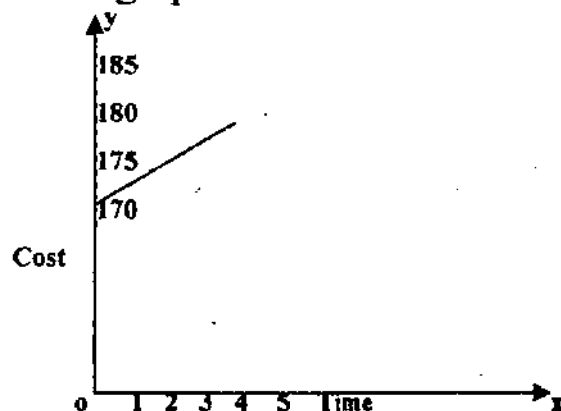
When $n = 4$ then put in (i)

$$C = 4(2.5) + 170 = 10 + 170 = 180$$

Thus the table is

x	0	1	2	3	4
y	170	172.5	175	177.5	180

Now the graph is

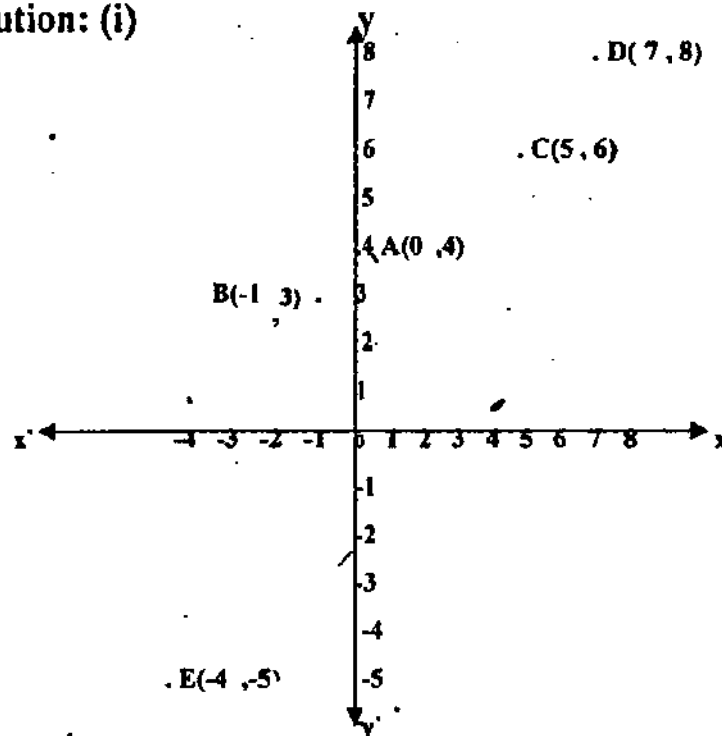


Q.9: Draw graph form the following tables using a suitable scale.

x	0	-1	5	7	-4
y	4	3	6	8	-5

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Solution: (i)



Exercise 9.3.

Q.1: Using the conversion formula $1 \text{ M} = 1.6 \text{ km}$

Draw the conversion graph of miles – kilometers.

If distance in miles are given as; 1 M, 3 M

4 M, 5 M (M is used for mile).

Solution: Since $1 \text{ M} = 1.6 \text{ Km}$.

x (M)	1	3	4	5
y (Km)	1.60	4.80	6.40	8.00

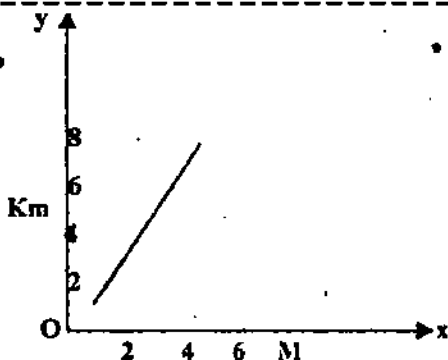
Scale : Take $1 \text{ M} = 1 \text{ unit}$ along x-axis

$1 \text{ Km} = 1 \text{ unit}$ along y-axis.

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Q.2: Draw the graph of miles – kilometers of distance in kilometers are given as 1 Km , 2Km , 3Km , 4 Km (Km is used for kilometer)..

Solution: AS $1.60 \text{ Km} = 1 \text{ M}$

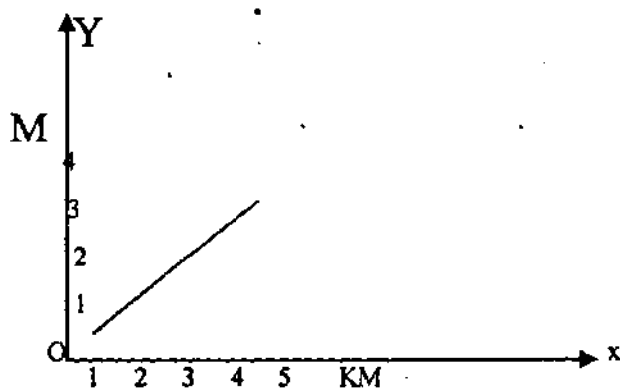
$$\Rightarrow 1 \text{ Km} = \frac{1}{1.60} = 0.625 \text{ Then}$$

x(Km)	1	2	3	4	5
y(M)	0.625	1.25	1.875	2.5	3.125

Scale : Take 1 Km = 1 unit along x- axis

1 M = 1 unit along y- axis.

Now the graph is



Q.3: Given that 1 Hectare = 2.5 Acres(approximately)

Draw a conversation hectare Acre from the given values of Hectares 2 H , 4 H , 8 H.

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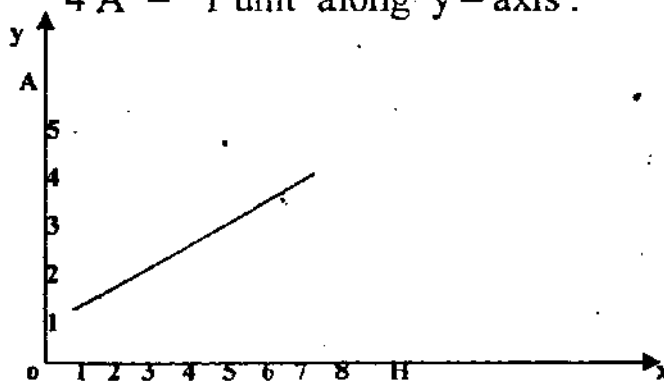
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Solution: Given $1 \text{ H} = 2.5 \text{ A}$. Then

H	2	4	8
A	5	10	20

Scale: $1 \text{ H} = 1 \text{ unit along x-axis}$

$4 \text{ A} = 1 \text{ unit along y-axis}$.



Q.4: Convert the following temperatures given in Celsius Degrees into Fahrenheit and then draw its graph. Degree Celsius = 0° , 2° , 3°

Conversion formula is $F^\circ = \frac{9}{5}C^\circ + 32$.

Solution: Given $F^\circ = \frac{9}{5}C^\circ + 32 \dots(i)$

put $C^\circ = 0$ in (i)

$$F^\circ = \frac{9}{5}(0) + 32 = 32^\circ$$

put $C^\circ = 2$ in (i)

$$F^\circ = \frac{9}{5}(2) + 32 = \frac{18 + 160}{5}$$

$$\Rightarrow F^\circ = \frac{178}{5} = 35.6$$

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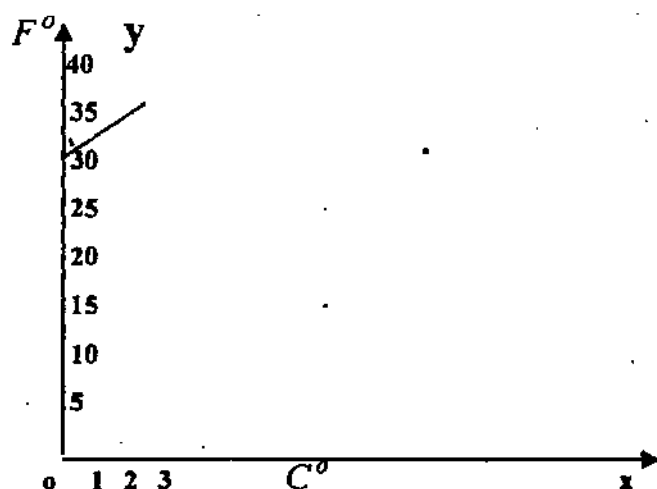
Put $C^o = 3$ in (i)

$$F^o = \frac{9}{5}(3) + 32 = \frac{27+160}{5}$$

$$\Rightarrow F^o = \frac{187}{5} = 37.4$$

Now the graph let $1 C^o = 1$ unit along x-axis.

$5 F^o = 1$ unit along y-axis.



Q.5: Draw the following conversion graphs.

(i) PKR (Pakistani Rupees) –US \$

(1 \$, 2\$, 3\$). Where \$ = US dollars

(ii) 1 PKR (Pakistani rupees)- GB£

(1 £ , 2£ , 3£). where £ = Pound sterling

Where 1 \$ = RS. 60 PKR

1GB£= Rs. 100 Pkr.

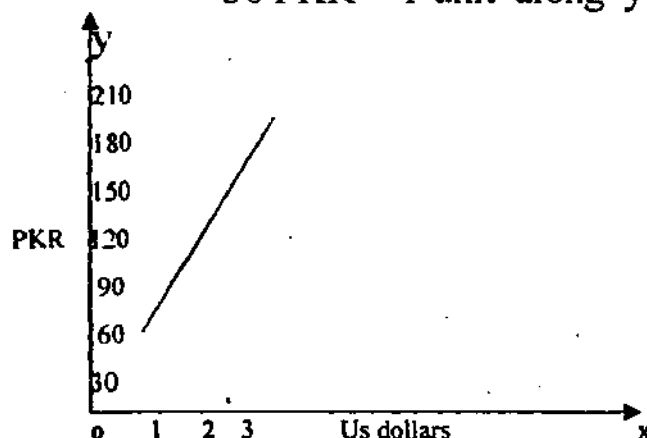
Solution: (i) Given 1 S = Rs. 60 then.

X(US\$)	1	2	3
Y(PKR)	60	120	180

Scale: (i) Let 1\$ = 1 unit along x-axis.

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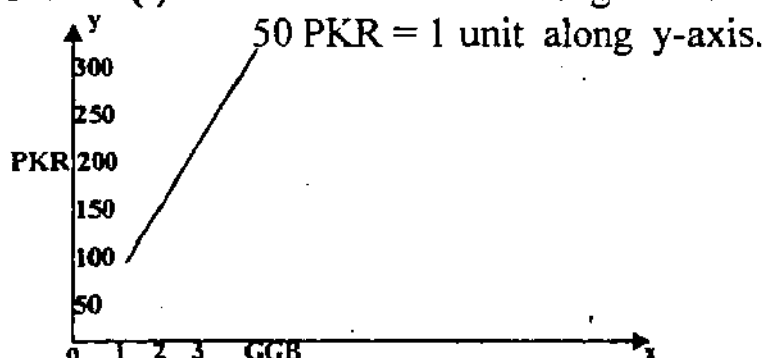
30 PKR = 1 unit along y-axis.



(ii) (i) Given 1 GB£ = Rs. 100 then.

X(US\$)	1	2	3
Y(PKR)	100	200	300

Scale: (i) Let 1 GB£ = 1 unit along x-axis.



Q.6: Solve the following simultaneous by using Graphical methods.

(i) $2x + y = 3$, $x - y = 0$ (ii) $y = 2x + 2$, $y = x - 1$

(iii) $x + 4y = 5$, $2x + 3y = 0$ (iv) $3x + 5y = 2$, $3x + 5y = 8$

(v) $3x - 2y = 13$, $2x + 3y = 13$

Solution: (i) $2x + y = 3$(i) , $x - y = 0$ (ii)

The tables are constructed showing the values of x and y satisfying both equations.

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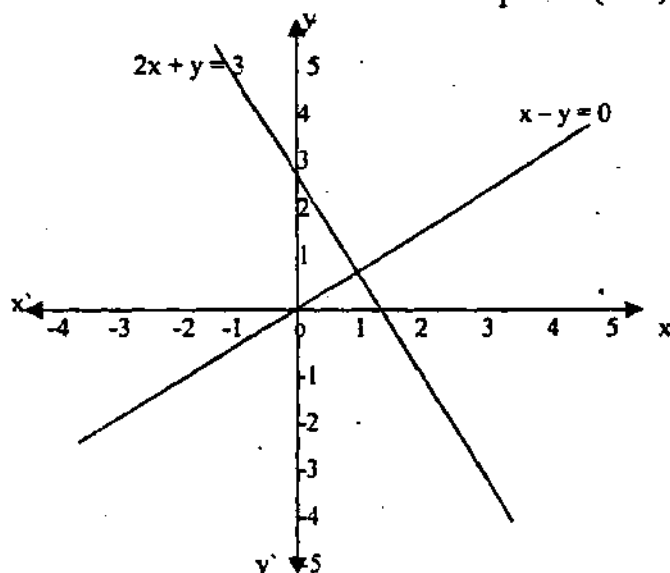
Table for $2x + y = 3$

x	-1	0	1	2	3	4
y	5	3	1	-1	-3	-5

Table for $x - y = 0$

x	-1	0	1	2	3	4
y	-1	0	1	2	3	4

Plot the points from both tables on the graph and then draw straight line joining all the points corresponding to the given equations. In the graph the two lines are intersected each other at point (1, 1).



Thus the solution (i) and (ii) is (1, 1).

(ii) $y = 2x + 2$, $y = x - 1$

The tables are constructed showing the values of x and y satisfying both equations.

Table for $y = 2x + 2$

x	-3	-2	-1	0	1	2
y	-4	-2	0	2	4	6

Table for $y = x - 1$

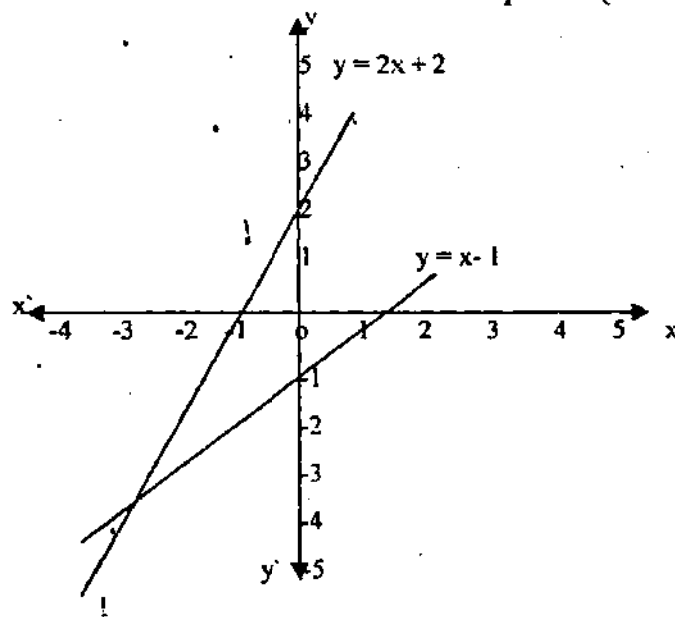
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x	-3	-2	-1	0	1	2
y	-4	-3	-2	-1	0	1

Plot the points from both tables on the graph and then draw straight line joining all the points corresponding to the given equations. In the graph the two lines are intersected each other at point $(-3, -4)$.



The point $(-3, -4)$ is the solution.

(iii) $x + 4y = 5$, $2x + 3y = 0$

The tables are constructed showing the values of x and y satisfying both equations.

Table for $x + 4y = 5$

x	-7	-3	1	5	9	13
y	3	2	1	0	-1	-2

Table for $2x + 3y = 0$

x	-3	0	3	6	9	12
y	2	0	-2	-4	-6	-8

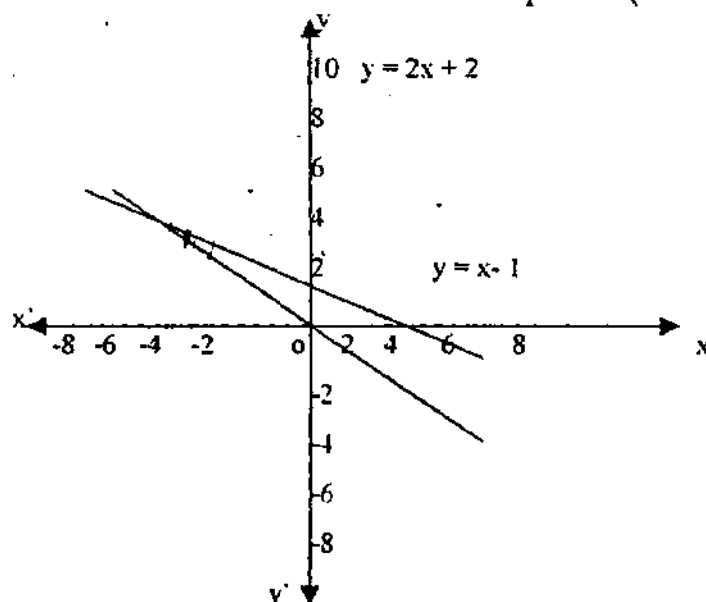
Plot the points from both tables on the graph and then

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draw straight line joining all the points corresponding to the given equations. In the graph the two lines are intersected each other at point $(-3, 2)$.



Thus the point $(-3, 2)$ is the solution.

(iv) $3x + 5y = 2$, $3x + 5y = 8$

The tables are constructed showing the values of x and y satisfying both equations.

Table for $3x + 5y = 2$

x	-1	0	1	2	3	4
y	1	$\frac{2}{5}$	$-\frac{1}{5}$	$-\frac{4}{5}$	$-\frac{7}{5}$	-2

Table for $3x + 5y = 8$

x	-1	0	1	2	3	
y	$\frac{11}{5} = 2.2$	$\frac{8}{5} = 1.6$	1	$\frac{2}{5} = .4$	$-\frac{1}{5}$	

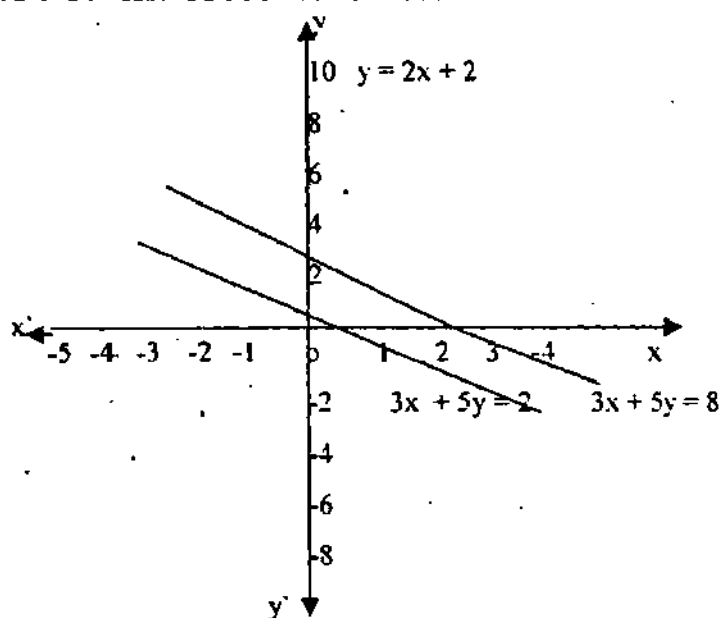
Plot the points from both tables on the graph and then draw straight line joining all the points corresponding to the given equations. In the graph the two lines

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does not intersect each other .



The two lines does not intersect each other.

Thus the solution set is $\{ \}$.

(v) $3x - 2y = 13$, $2x + 3y = 13$

The tables are constructed showing the values of x and y satisfying both equations.

Table for $3x - 2y = 13$

x	-1	1	3	5	7	
y	-8	-5	-2	1	4	

Table for $2x + 3y = 13$

x	-4	-1	2	5	8	
y	7	5	3	1	-1	

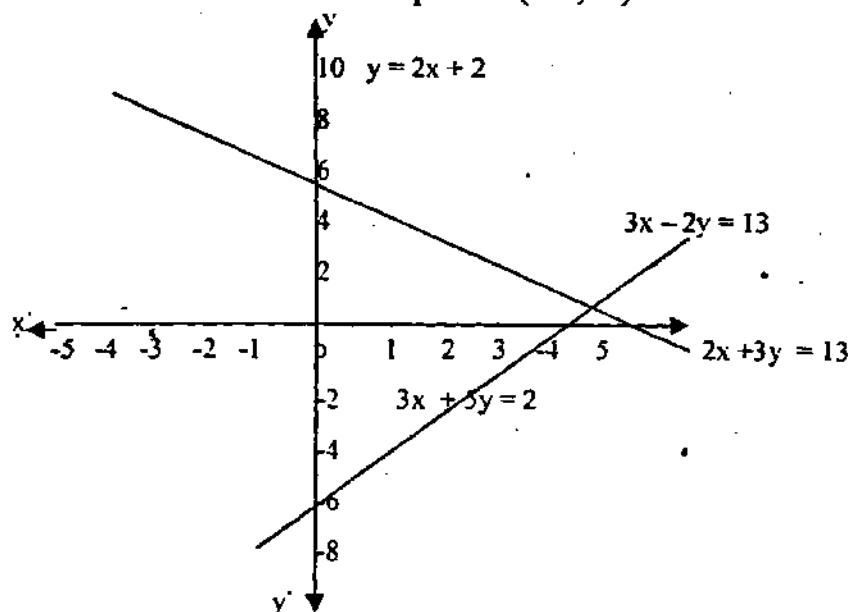
Plot the points from both tables on the graph and then draw straight line joining all the points corresponding to the given equations. In the graph the two lines

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intersect each other at point (5 , 1) .



Thus the solution set is $\{(5, 1)\}$.

Exercise 9.4 (Objective type questions).

Q.1: True and false questions.

Read the following sentences carefully and encircle “T” in case of true and “F” in case of false statement.

(i) *The cartesian plane is also called xy – plane* T – F

(ii) *In sceond quadrant both x and y coordinates are positive.* T – F

(iii) *The point (1 , 2) lies in Quadrant I.* T – F

Answers: (i) T (ii) F (iii) T

Q.2: Four suggested answers are given for each question . Select the correct answer and write the corresponding letter a , b , c or d in the box.

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- (i) The point $(3, -4)$ is located
- (a) Quadrant I (b) Quadrant II
(c) Quadrant III (d) Quadrant IV
- (ii) The two coordinates axes intersect at an angle of
- (a) 30° (b) 60°
(c) 90° (d) 45°
- (iii) The lines representing by the equations
 $x + y = 3$ and $x + y = 2$ are
- (a) Parallel (b) perpendicular
(c) Intersecting (d) Inclined
- (iv) The line $y = a$ where a is real number is
parallel to (a) x -axis (b) y -axis
(c) Both x -axis and y -axis (d) Neither x -axis nor y -axis
- (v) The solution set of the lines $x = 1$ and $x = 2$ is
- (a) $\{(1, 2)\}$ (b) $\{(2, 0)\}$
(c) $\{(2, 0)\}$ (d) $\{ \}$
- (vi) The line $x = 1$ is parallel to
- (a) x -axis (b) y -axis
(c) Both x -axis and y -axis (d) Neither x -axis nor y -axis.

Solution: (i) d (ii) c (iii) a (iv) a (v) d (vi) b

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UNIT No .10:

Basic Statics:

Frequency distribution: The group frequency table is a statistical method to organize and simplify a large set of data into smaller groups .

Group Frequencies: The number of appearing a number is called frequency . For example in an examination if 10 students scored 80 numbers in Maths paper . Then frequency is 10.

Class limit: The selected number which shows the start and end of a class is called class limit.

Every class has two limits ,the upper class limit and lower class limit . for each class the two limits may be fixed such that the mid point of each class falls on an integer . mid point of each class is calculated as

$$\text{mid point} = \frac{\text{lower class limit} + \text{upper class limit}}{2}$$

Class width: The difference between the upper and lower class boundaries is called class width .

For example

$$5 - 1 = 4 \text{ is the class width .}$$

Histogram: A Histogram is a graph in which the data is represented in the forms of adjacent rectangles .

The base of the rectangle shows the class boundaries and the height shows the frequency of that class.

In unequal class intervals the area of rectangle shows the frequency of that class.

Frequency polygon: A frequency polygon is a graphical representation of frequency distribution. A frequency polygon is drawn by joining all the mid points of rectangles of a histogram .

Exercise 10.1:

Q.1: Define statistics . Describe at least five application Statistics in our practical life .

Solution: Statistics is that branch of science which deals with the systematic collection of numerical facts

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or the discipline that includes procedures and techniques used to collect, process and analyze numerical data to make inference and to reach decision in the face of uncertainty.

Five application of statistics in our practical life:

- (i) Statistics are used in insurance companies.
- (ii) Statistics are used in industries.
- (iii) Statistics are used in information technologies.
- (iv) Statistics are used in agriculture.
- (v) Statistics are used in business.

Q.2: What is meant by frequency distribution?

Solution: The arrangement of data according to their frequencies is called frequency distribution. Frequency is the number of observations of particular values of a particular group.

Q.3: Complete the following table.

Class -limit	Class - interval	Class-marks (mid points)	Class - Boundaries
1 – 3	3	2	0.5 – 3.5
2 – 4	3		
3.1 – 3.5			
1.10 – 1.20			

Solution:

Class -limit	Class - interval	Class-marks	Class - Boundaries
1 – 3	3	2	0.5 – 3.5
2 – 4	3	3	1.5 – 4.5
3.1 – 3.5	0.5	3.3	3.05 – 3.55
1.10 – 1.20	0.11	1.5	1.095 – 1.205

Q.4: Write the following data in ascending and descending order. 20, 25, 34, 42, 58, 33, 40, 24, 32, 50.

Solution: Ascending order:

20, 24, 25, 32, 33, 34, 40, 42, 50, 58.

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

Descending order :

58 , 50 , 42 , 40 , 34 , 33 , 32 , 25 , 24 , 20 .

Q.5: Construct a frequency distribution of the marks of 30 students during a quiz with 100 points by taking 10 as the class – interval .Indicate the class – boundaries and class – marks .

40 , 60 , 65 , 70 , 35 , 50 , 56 , 74 , 72 , 49 , 85 , 76 , 82 , 83 , 68 , 90 , 67 , 66 , 58 , 46 , 74 , 88 , 76 , 69 , 57 , 63 , 66 , 47 , 82 , 90 .

Solution: Here the lowest number is 35 and highest number is 90 .

Class limits	Tallymarks	Frequency (f)
35 – 45		2
46 – 55		4
56 – 65		6
66 – 75		9
76 – 85		6
86 – 90		3

Q.6: Define (i) Histogram (ii) Frequency polygon

Solution: (i)

Histogram: A Histogram is a graph in which the data is represented in the forms of adjacent rectangles .

The base of the rectangle shows the class boundaries and the height shows the frequency of that class.

In unequal class intervals the area of rectangle shows the frequency of that class.

(ii)**Frequency polygon:** A frequency polygon is a graphical representation of frequency distribution. A frequency polygon is drawn by joining all the mid points of rectangles of a histogram .

Q.7: Draw a histogram for the following data

Class limits	20-24	25 – 29	30 – 34	35 – 39	40 – 44	45 – 49	50 – 54
Freque ncy	1	3	4	5	4	2	1

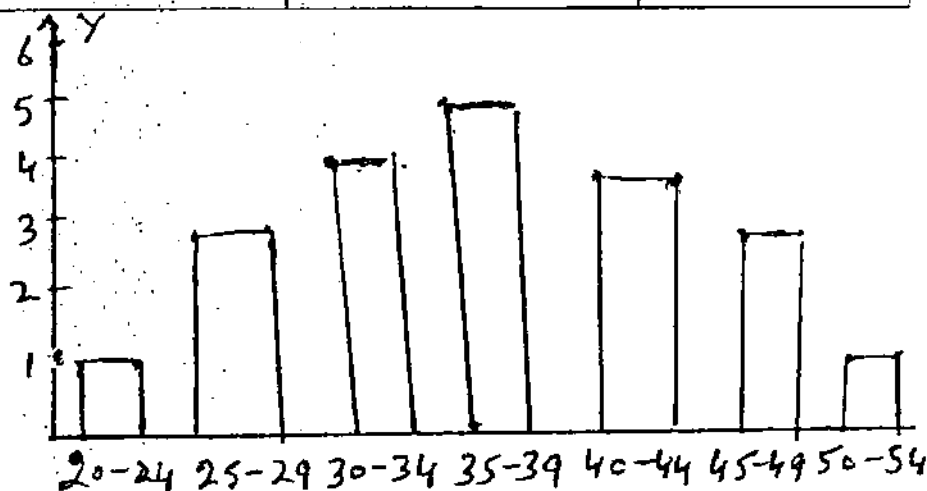
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Solution: To draw a histogram class boundaries are marked along x-axis and frequencies of each class are marked along Y-axis as shown in the figure.

Class – limits	Frequency	Class boundaries
20 – 24	1	19.5 – 24.5
25 – 29	3	24.5 – 29.5
30 – 34	4	29.5 – 34.5
35 – 39	5	34.5 – 39.5
40 – 44	4	39.5 – 44.5
45 – 49	2	44.5 – 49.5
50 – 54	1	49.5 – 54.5



Q.8: The following data give the weights in (kg) of the students in the 10th class.

25, 30, 32, 29, 24, 40, 36, 37, 28, 27, 41, 42, 35,
 39, 31, 32, 34, 42, 40, 43, 36, 26, 22, 23, 42,
 39, 35, 41, 39, 29.

(i) Prepare a frequency distribution using a suitable

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Class interval .

(ii) Draw histogram and frequency – polygon.

Solution: (i) Here minimum weight = 22

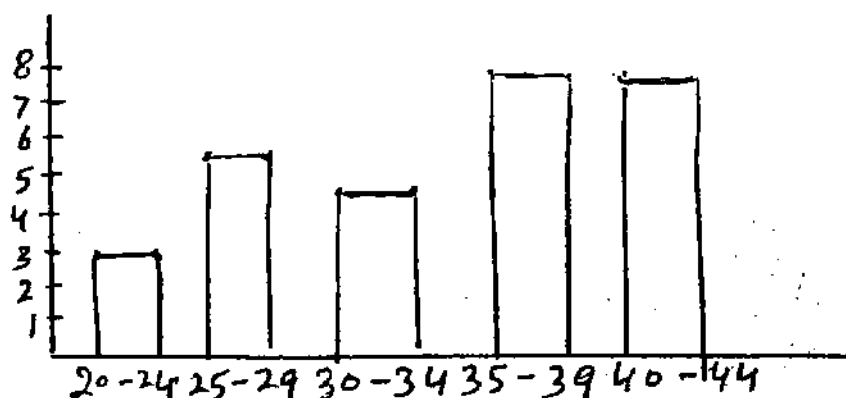
And maximum weight = 43 .

We take width of class interval 4 .

Class limits	Tally marks	frequency
20 – 24		3
25 – 29		6
30 – 34		5
35 – 39		8
40 – 44		8

(ii) Histogram:

Class – limits	Frequency	Class boundaries
20 – 24	3	19.5 – 24.5
25 – 29	6	24.5 – 29.5
30 – 34	5	29.5 – 34.5
35 – 39	8	34.5 – 39.5
40 – 44	8	39.5 – 44.5

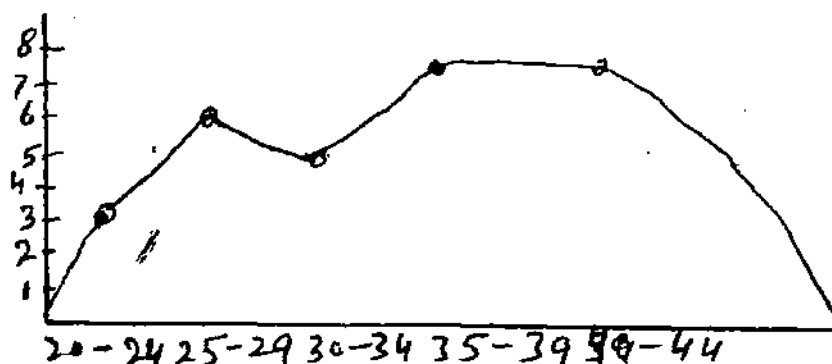


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Frequency polygon:

Class – limits	Class boundaries	Class Marks (mid points)	Frequency
20 – 24	19.5 – 24.5	19.5 – 24.5	3
25 – 29	24.5 – 29.5	24.5 – 29.5	6
30 – 34	29.5 – 34.5	29.5 – 34.5	5
35 – 39	34.5 – 39.5	34.5 – 39.5	8
40 – 44	39.5 – 44.5	39.5 – 44.5	8

Frequency polygon graph



Cumulative frequency table: A cumulative frequency table is obtained by adding successive class frequencies.

Cumulative Frequency polygon: A polygon in which cumulative Frequency is used for plotting the curve is called cumulative frequency polygon.

The curve is also called ogive.

Exercise 10.2:

Q.1: The following data give the wages (in Rs) of workers. 60, 75, 80, 85, 90, 84, 95, 100, 150, 66, 58, 90, 98, 120, 77, 90.

By Taking 10 as the class interval, prepare.

GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

- (i) Frequency distribution .
- (ii) Cumulative frequency distribution .
- (iii) Draw a histogram .
- (iv) frequency polygon .
- (v) Cumulative frequency polygon .

Solution: (i) Frequency distribution

As class interval = 10 .

Class - limits	Tilly marks	Frequency (f)	
55 – 64	54.5 – 64.5	2	
65 – 74	64.5 – 74.5	3	
75 – 84	74.5 – 84.5	6	
85 – 94	84.5 – 94.5	4	
95 – 104	94.5 – 104.5	3	
105 – 114	104.5 – 114.5	0	
115 – 124	114.5 – 124.5	1	
125 – 134	124.5 – 134.5	0	
135 – 144	134.5 – 144.5	0	
145 – 154	144.5 – 154.5	1	

(ii) Cumulative frequency distribution

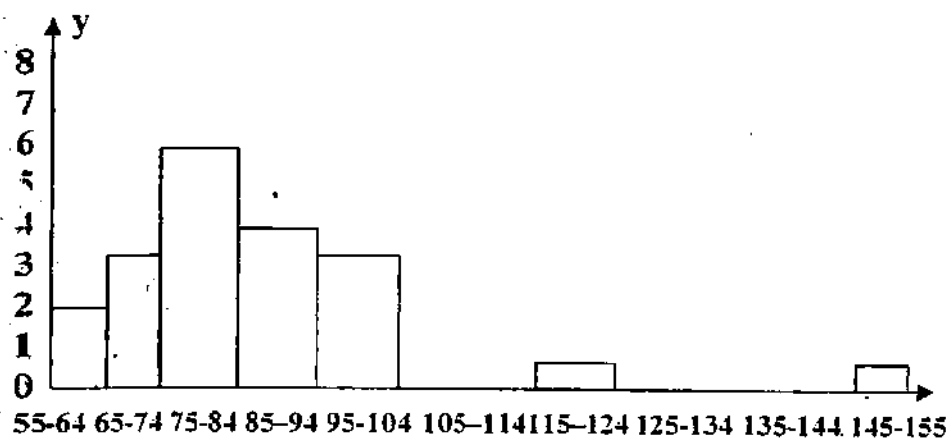
As class interval = 10 .

Class - limits	Class boundaries	Frequency (f)	Cumulative Frequency (c.f)
55 – 64	54.5 – 64.5	2	2
65 – 74	64.5 – 74.5	3	2 + 3 = 5
75 – 84	74.5 – 84.5	6	5 + 6 = 11
85 – 94	84.5 – 94.5	4	11 + 4 = 15
95 – 104	94.5 – 104.5	3	15 + 3 = 18
105 – 114	104.5 – 114.5	0	18 + 0 = 18
115 – 124	114.5 – 124.5	1	18 + 1 = 19

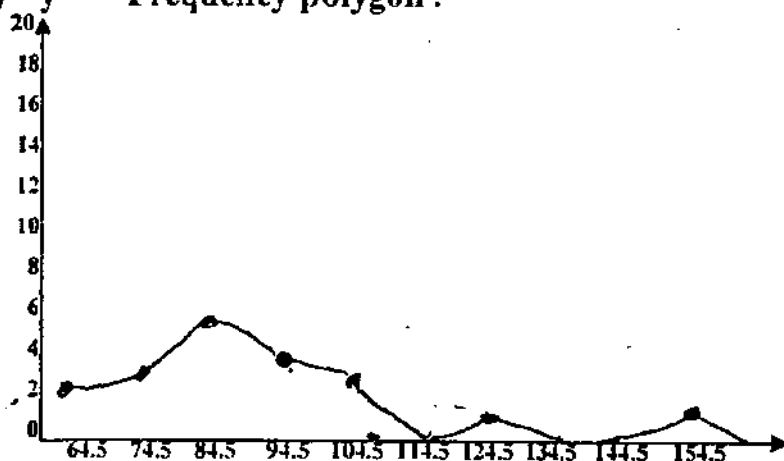
GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

125 – 134	124.5 – 134.5	0	$19 + 0 = 19$
135 – 144	134.5 – 144.5	0	$19 + 0 = 19$
145 – 154	144.5 – 154.5	1	$19 + 1 = 20$

(iii) Histogram:



(iv) Frequency polygon .



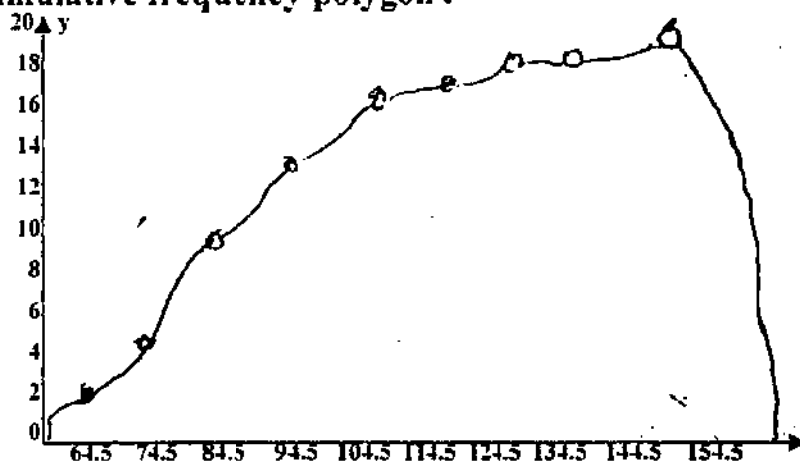
Take upper class boundaries.

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(v) Cumulative frequency polygon .



Take upper class boundaries.

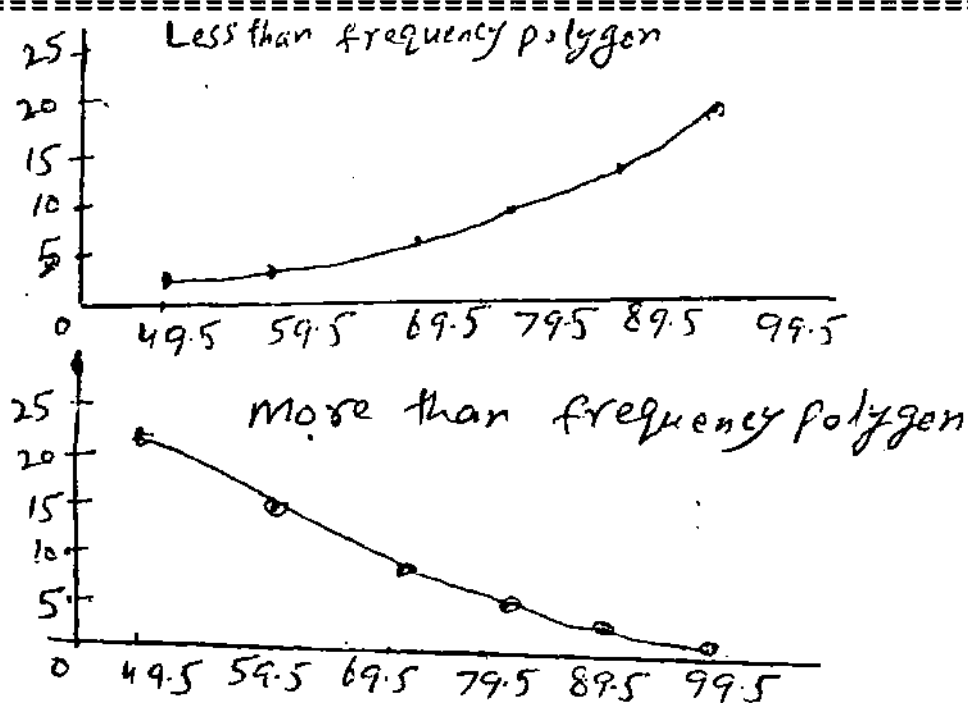
Q.3: Draw less than and more than cumulative frequency polygon for the data given .

Marks	Number of students
40 – 49	1
50 – 59	2
60 – 69	3
70 – 79	4
80 – 89	5
90 – 99	6

Solution: we construct the cumulative frequency table .

Class - limits	Class boundaries	Frequency	Cumulative frequency
40 – 49	40.5 – 49.5	1	1
50 – 59	49.5 – 59.5	2	1 + 2 = 3
60 – 69	59.5 – 69.5	3	3 + 3 = 6
70 – 79	69.5 – 79.5	4	6 + 4 = 10
80 – 89	79.5 – 89.5	5	10 + 5 = 15
90 – 99	89.5 – 99.5	6	15 + 6 = 21

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Q.3: Determine from the data of Q .2 , the following .

- Number of students who obtained marks more than 50.
- Number of students who obtained marks less than 70.
- Number of students who secured marks between 50 and 70 .
- class interval of all classes .
- lower class boundary of 5th class .

Solution: (i) Number of students who obtained more than 50 marks are 20 .

(ii) Number of students who obtained less than 70 marks are 6 .

(iii) Number of students who secured marks between 50 and 70 are 5 .

(iv) class interval of all classes is 10 .

(v) lower class boundary of 5th class is 79.5 .

Arithmetic Mean: (For simple data):

If $x_1, x_2, x_3, \dots, x_n$ are n observations then Arithmetic

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mean is denoted by \bar{x} and given by

$$\bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n}$$

$$\Rightarrow \bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

By short cut method :

formula for short cut method is

$$\bar{x} = a + \frac{\sum D_x}{n}$$

Where \bar{x} = Arithmetic mean ,

a = provisional mean (P.M)

$D_x = x - a$ (deviation from P.M.)

$\sum D_x$ = sum of deviation from P.M.

n = total number of values in the data .

Arithmetic Mean:(for group data) :

If $x_1, x_2, x_3, \dots, x_n$ are n observations and their

Frequencies are $f_1, f_2, f_3, \dots, f_n$ respectively .

Then Arithmetic Mean is given by

$$\begin{aligned} \bar{x} &= \frac{f_1 x_1 + f_2 x_2 + \dots + f_n x_n}{f_1 + f_2 + \dots + f_n} \\ &= \frac{\sum fx}{\sum f} \end{aligned}$$

By short cut method :

formula for short cut method is

$$\bar{x} = a + \frac{\sum fm_x}{\sum f}$$

Calculating Mean by assuming average: If “a” is assumed

Mean which is taken approximately from the center.

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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Then for ungrouped data Mean is given by

$$\bar{x} = a + \frac{\sum D}{n}$$

For grouped data Mean is given by

$$\bar{x} = a + \frac{\sum fD}{\sum f}$$

Where $D = x_i - a$ and x_i are the average of each class.

Median: (For ungrouped data): If the data are arranged in descending or ascending then central value of the data is called median. If the number of observations "n" are odd then the median is the value of $\frac{(n+1)}{2}$ th observation.

If the number of observations "n" are even then median is the Average of values of $\frac{n}{2}$ th and $\frac{(n+2)}{2}$ th observations.

Median for discrete data: In a frequency distribution if

$\sum f$ is odd then the values of x opposite to $\sum \left(\frac{f+1}{2} \right)$ th item in the cumulative frequency column is its medium.

if $\sum f$ is odd then the values of x opposite to $\sum \left(\frac{f}{2} \right)$ th item in the cumulative frequency column is its medium.

Median for continuous data:

If $x_1, x_2, x_3, \dots, x_n$ are the mid values of given groups and $f_1, f_2, f_3, \dots, f_n$ are their frequencies. Then the median is given by

$$\text{Median} = l + \frac{h}{f} \left(\frac{n}{2} - c \right),$$

Where l = lower limit of class containing median

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h = class interval , f = frequency of class containing median.

n = total number of values ($n = \sum f$)

Mode: The value which occurs most in a set of observations is Called Mode .The data in which no value is repeated has no mode and if more than one value is equally repeated then data has more than one mode.

Mode for grouped data: The Mode for grouped data is given

$$\text{by } \text{Mode} = l + \frac{(f_m - f_o)}{(2f_m - f_o - f_1)} \times h$$

where l = lower boundary of model class.

f_m = frequency of Model class .

f_o = frequency of class preceding Model class

f_1 = frequency of class following the model class.

The class whose frequencies are large is called Model class.

Geometric Mean: It is defined as the n th root of product of n values . Let the values are $a_1, a_2, a_3, \dots, a_n$. Then

$$\text{Geometric mean} = \sqrt[n]{a_1 \times a_2 \times a_3 \times \dots \times a_n}$$

If number of observations are large then

$$\text{Geometric Mean} = \text{Antilog} \left(\frac{1}{n} \sum \log x \right)$$

Geometric Mean from grouped data: G . M . from grouped data

$$\text{is find by } \text{G . M .} = \text{Antilog} \left(\frac{\sum f_i \log x_i}{\sum f} \right)$$

Harmonic Mean: it is the reciprocal of arithmetic mean of

observations . For ungrouped data H . M . is

$$\text{H.M.} = \frac{n}{\sum \frac{1}{x_i}}$$

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GENERAL MATHEMATICS NOTES FOR 9TH CLASS (FOR KHYBER PAKHTUNKHWA)

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For grouped data the H . M . is

$$H.M = \frac{\sum f}{\sum f_i \times \frac{1}{x_i}}$$

Exercise 10.3:

Q.1: The following are the marks scored of the 9th grade.

45 , 30 , 25 , 36 , 42 , 27 , 31 , 43 , 49 , 50

Calculate their average score .

Solution: let \bar{x} is the average .

Total number of scores = n = 10

Then

$$\bar{x} = \frac{45 + 30 + 25 + 36 + 42 + 27 + 31 + 43 + 49 + 50}{10}$$

$$\Rightarrow \bar{x} = \frac{378}{10} = 37.8$$

Q.2: Find the mean of the scores given in question 1
by using short cut method .

Solution: let we take mean a from the middle .

Let we take $a = 42$

x	$D_x = x - a$
45	$45 - 42 = 3$
30	$30 - 42 = -12$
25	$25 - 42 = -17$
36	$36 - 42 = -6$
42	$42 - 42 = 0$
27	$27 - 42 = -15$
31	$31 - 42 = -11$
43	$43 - 42 = 1$
49	$49 - 42 = 7$
50	$50 - 42 = 8$
	$\sum D_x = -42$

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$$\text{As } \bar{x} = a + \frac{\sum D_x}{n} \text{ put } a = 42, n = 10, \sum D_x = -42$$

$$\Rightarrow \bar{x} = 42 + \frac{-42}{10} = 42 - 4.2 = 37.8 \text{ Ans.}$$

Q.3: In a group of 20 boys, one boy has Rs.10, four boys have Rs.20, each ten boys have Rs.30, four boys have Rs.40 each and one boy has Rs. 50.

- (i) Construct a table for the given data.
 (ii) Calculate the average amount per student in the group both by Direct method and short – cut –method.

Solution: (i) Construction of a table for the given data.

Since the boys have 10, 20, 30, 40 and 50 rupees.

There fore we take assumed mean = $a = 30$ and “ x ” take as a rupees.

x	f	$f.x$	$D_x = x - a$ $D_x = x - 30$	$f.x.D_x$
10	1	10	$10 - 30 = -20$	$1 \times (-20) = -20$
20	4	80	$20 - 30 = -10$	$4 \times (-10) = -40$
30	10	300	$30 - 30 = 0$	$10 \times 0 = 0$
40	4	160	$40 - 30 = 10$	$4 \times 10 = 40$
50	1	50	$50 - 30 = 20$	$1 \times 20 = 20$
	$\sum f = 20$	$\sum fx = 600$	$\sum D_x = 0$	$\sum fx D_x = 0$

(ii) **By direct method :**

$$\text{Average} = \frac{\sum fx}{\sum f} \text{(i), Put values}$$

$$\text{Average} = \frac{600}{20} = 30$$

By Short cut method : Here $\sum D_x = 0$, $n = 5$ and

Assumed mean = $a = 30$

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$$\text{Average} = a + \frac{\sum D_x}{n} \quad \text{put values}$$

$$\Rightarrow \text{Average} = 30 + \frac{0}{5} = 30$$

Q.4: Calculate the Arithmetic mean by method from the following data .

Classes	0- 10	10- 20	20- 30	30 - 40	40 - 50
frequency	1	4	2	3	5

Solution:

Class-interval	Mid point (x)	f	f . x.
0 - 10	$\frac{0+10}{2} = \frac{10}{2} = 5$	1	$5 \times 1 = 5$
10 - 20	15	4	$15 \times 4 = 60$
20 - 30	25	2	$25 \times 2 = 50$
30 - 40	35	3	$35 \times 3 = 105$
40 - 50	45	5	$45 \times 5 = 225$
		$\sum f = 15$	$\sum fx = 445$

$$\text{Average} = \frac{\sum fx}{\sum f} = \frac{445}{15} = 29.7$$

Q.5: Find the median of the following values:

3 , 4 , 6 , 8 , 11

Median:

First we write in ascending order

3 , 4 , 6 , 8 , 11

Since the number of observations are $n = 5$ which are odd

$$\begin{aligned} \text{Median} &= \left(\frac{n+1}{2} \right) \text{th item} = \left(\frac{5+1}{2} \right) \text{th item} \\ &= \left(\frac{6}{2} \right) \text{th item} = 3 \text{th item} \end{aligned}$$

Hence 3rd item is the median whose value is 6 .

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Q.6: The following are the ages (in years) of some students
 10, 12, 13, 15, 16, 14.

Calculate the median of their ages.

Solution: In ascending order 10, 12, 13, 14, 15, 16.

Here total number of students = $n = 6$, which is even.

Then the median is the average of 3rd and 4th observations.

Whose values are 13 and 14.

$$\begin{aligned} \text{Median} &= \frac{13+14}{2} \\ &= \frac{27}{2} \\ &= 13.5 \end{aligned}$$

Q.7: The distribution given below gives the marks in Mathematics test of 30 students. Find the median of marks.

Marks	1	4	5	7	9	10
No. of students	5	7	10	3	3	2

Solution:

Marks (x)	No. of students(f)	c. f.
1	5	5
4	7	$5 + 7 = 12$
5	10	$12 + 10 = 22$
7	3	$22 + 3 = 25$
9	3	$25 + 3 = 28$
10	2	$28 + 2 = 30$
	$n = \sum f = 30$	

$$\text{Median} = \text{Size of } \left(\frac{n}{2}\right)^{\text{th}} \text{ item ,}$$

$$\Rightarrow \text{Median} = \text{size of } \left(\frac{30}{2}\right)^{\text{th}} \text{ item}$$

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\Rightarrow Median = size of 15th item .

Since 15 is greater than 12 and less than 22 . Then the Median is lie in front of 22 in c.f column which is 5 .

Thus median = 5 .

Q.8: From the following distribution

Daily wages (in Rs)	112 – 116	117 – 121	122 – 126	127 – 131	132 – 136
No. of workers	3	20	11	4	5

(i) Construct a frequency table .

(ii) : Find the class – boundaries for each group .

(iii) : Calculate Median wages

Solution: frequency table and class boundaries .

Class limits	Frequency	Class boundaries	Cumulative frequency
112 – 116	3	111.5 – 116.5	3
117 – 121	20	116.5 – 121.5	3 + 20 = 23
122 – 126	11	121.5 – 126.5	23 + 11 = 34
127 – 131	4	126.5 – 131.5	34 + 4 = 38
132 – 136	5	131.5 – 136.5	38 + 5 = 43
	$n = \sum f$ = 43		

(iii) Median = $\frac{n}{2}$ th item = $\frac{43}{2} = 21.5$.

Hence the median lies in the group 116.5 – 121 .5 .

As median = $l + \frac{h}{f} \left(\frac{n}{2} - c \right)$ (i)

Put $l = 116.5$, $h = 121.5 - 116.5 = 5$, $f = 20$.

$c = 3$ (c.f. of preceding group)

$n = \sum f = 43$ in (i)

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$$\begin{aligned} \text{median} &= 116.5 + \frac{5}{20} \left(\frac{43}{2} - 3 \right) = 116.5 + 0.25(21.5 - 3) \\ &= 116.5 + 4.625 = 121.125 \text{ Ans.} \end{aligned}$$

Q.9: From Q.8, find the following

(i) Mode (ii) Harmonic mean (iii) Geometric mean

Solution:

Class limits	Frequency	Class boundaries	Cumulative frequency
112 - 116	3	111.5 - 116.5	3
117 - 121	20	116.5 - 121.5	3 + 20 = 23
122 - 126	11	121.5 - 126.5	23 + 11 = 34
127 - 131	4	126.5 - 131.5	34 + 4 = 38
132 - 136	5	131.5 - 136.5	38 + 5 = 43
	$n = \sum f$ = 43		

(i) **Mode:** As the number of workers are most in 117 - 121 which is 20.

Thus the modal group is 117 - 121.

$$\text{As Mode} = l + \left(\frac{f_m - f_o}{2f_m - f_o - f_1} \right) \times h \text{(ii)}$$

$$\text{Put } l = 117, f_m = 20, f_o = 3, f_1 = 11,$$

$$h = 121 - 117 = 4 \text{ in (i).}$$

$$\text{Mode} = 117 + \left(\frac{20 - 3}{2(20) - 3 - 11} \right) \times 4 = 117 + \left(\frac{17}{40 - 14} \right) \times 4$$

$$= 117 + \left(\frac{17}{26} \right) \times 4 = 117 + 2.6154$$

$$\Rightarrow \text{Mode} = 119.6535$$

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(ii) Harmonic Mean :

Classes	Mid point of Interval (x)	Frequency (f)	$\frac{f}{x}$
112 – 116	114	3	$\frac{3}{114} = 0.026$
117 – 121	119	20	$\frac{20}{119} = 0.168$
122 – 126	124	11	$\frac{11}{124} = 0.887$
127 – 131	129	4	$\frac{4}{129} = 0.031$
132 – 136	134	5	$\frac{5}{134} = 0.037$
		$\sum f = 43$	$\sum \frac{f}{x} = 1.149$

$$\text{As } H.M = \frac{\sum f}{\sum \frac{f}{x}} = \frac{43}{1.149} = 37.4238$$

(iii) Geometric Mean :

Classes	Mid point of Interval (x)	Frequency (f)	Log x	f × log x
112 – 116	114	3	2.0569	6.1707
117 – 121	119	20	2.0755	41.51
122 – 126	124	11	2.0934	23.0274

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127 - 131	129	4	0.6020	2.408
132 - 136	134	5	0.6989	3.4945
		$\sum f$ = 43		$\sum f \log x$ = 76.6106

$$G.M = \text{Antilog} \left(\frac{\sum f \log x}{\sum f} \right) \text{ put values}$$

$$\Rightarrow G.M = \text{Antilog} \left(\frac{76.6106}{43} \right) = \text{Antilog}(1.7816)$$

$$\Rightarrow G.M = 60.48$$

Q.9: Find Median, Q_1 , Q_3 and Mode from the following distribution graphically.

classes	10 -14	15 - 19	20 - 24	25- 29	30 -34
frequency	1	3	7	12	2

Solution:

Class limits	Frequency (f)	Class boundaries	Cumulative Frequency (c.f)
10 - 14	1	9.5 - 14.5	1
15 - 19	3	14.5 - 19.5	1 + 3 = 4
20 - 24	7	19.5 - 24.5	4 + 7 = 11
25 - 29	12	24.5 - 29.5	11 + 12 = 23
30 - 34	2	29.5 - 34.5	23 + 2 = 25
	$n = \sum f$ = 25		

$$\text{Median} = \frac{n}{2} \text{th item} = \frac{25}{2} = 12.5.$$

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Hence the median lies in the group 24.5 – 29.5

$$\text{As median} = l + \frac{h}{f} \left(\frac{n}{2} - c \right) \dots\dots(i)$$

$$\text{Put } l = 24.5, \quad h = 29.5 - 24.5 = 5, \quad f = 12$$

$$c = 7 \text{ (c.f. of preceding group)}$$

$$n = \sum f = 25 \text{ in (i)}$$

$$\begin{aligned} \text{median} &= 24.5 + \frac{5}{12} \left(\frac{25}{2} - 7 \right) = 24.5 + 0.42(12 - 7) \\ &= 24.5 + 2.1 = 26.6 \text{ Ans.} \end{aligned}$$

$$\underline{Q_1}: \text{ As location for } Q_1 = \frac{n+1}{4} \text{th item} = \frac{25+1}{4} = 6.5 \text{th item}$$

Hence Q_1 is lies in the interval is 20 – 24 .

$$\text{Now } Q_1 = l + \frac{h}{f} \left(\frac{n+1}{4} - c.f \right) \dots\dots(i)$$

$$\text{Put } l = 20, \quad n = 25, \quad f = 7, \quad ,$$

$$h = 24.5 - 19.5 = 5$$

$$c.f = 4 = \text{cumulative frequency of the group above the group in which } Q_1 \text{ lies.}$$

put in (i)

$$Q_1 = 20 + \frac{5}{7} (6.5 - 4)$$

$$\begin{aligned} \Rightarrow Q_1 &= 20 + 0.72(2.5) \\ &= 20 + 1.78 = 21.78 \end{aligned}$$

$\underline{Q_3}$: As location for

$$\begin{aligned} Q_3 &= 3 \left(\frac{n+1}{4} \right) \text{th item} = 3 \left(\frac{25+1}{4} \right) = 3 \times 6.5 \\ &= 19.5 \text{th item} \end{aligned}$$

Hence Q_3 is lies in the interval is 25 – 29 .

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Now $Q_3 = l + \frac{h}{f} \left(3 \left(\frac{n+1}{4} \right) - c.f \right) \dots\dots(i)$

Put $l = 25$, $n = 25$, $f = 12$, $h = 5$,
 $c.f = 11 = \text{cumulative frequency of the group}$
 above the group in which Q_3 lies.

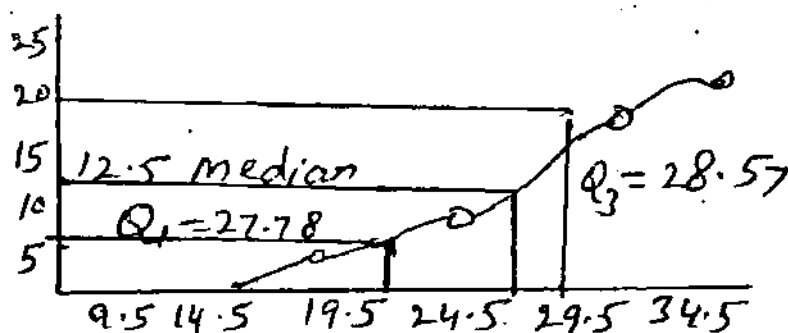
put in (i)

$$Q_3 = 25 + \frac{5}{12}(19.5 - 11)$$

$$\Rightarrow Q_3 = 25 + 0.42(8.5)$$

$$= 25 + 3.57 = 28.57$$

Graph of Median, Q_1 , Q_3 and Mode



Range: In given data the difference between the largest number and smallest number is called Rang.

Variance: Variance is defined as the sum of average of squares of difference of all the observations from average. It is denoted by S^2 and given by

$$S^2 = \frac{\sum (x_i - \bar{x})^2}{n} \quad \text{or}$$

$$S^2 = \frac{\sum x^2}{n} - \left(\frac{\sum x}{n} \right)^2 \quad \text{for, ungroup data}$$

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And

$$S^2 = \frac{\sum f(x - \bar{x})^2}{n} \quad \text{Or} \quad \frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2 \quad \text{for group}$$

and continuous data .

Standard Deviation (S.D.): The positive square root of variance
 Is called standard Deviation .

$$S.D. = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} \quad \text{For ungrouped data}$$

$$S.D. = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2} \quad \text{For grouped data}$$

$$\text{Or } S.D. = \sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}}$$

Exercise 10.4:

Q.1: Find the range for the following items.

11, 13, 15, 21, 19, 23 .

Solution: Here the largest value = 23

The smallest value = 11

Range = 23 - 11 = 12

Q.2: Calculate the Range ,Variance and Standard Deviation for the following data .

x	5	10	11	13	15
f	2	3	4	1	5

Solution: For range

x	f	xf
5	2	5 × 2 = 10
10	3	10 × 3 = 30
11	4	11 × 4 = 44
13	1	13 × 1 = 13
15	5	15 × 5 = 75
	$\sum f = 15$	$\sum fx = 172$

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The largest value = 75

The smallest value = 10

Range = 75 - 10 = 65 .

Now variance : in this case $\bar{x} = \frac{\sum fx}{\sum f} \Rightarrow \bar{x} = \frac{172}{15} = 11.47$

x	f	xf	$x - \bar{x}$	$(x - \bar{x})^2$	$f(x - \bar{x})^2$
5	2	10	5 - 11.47 = -6.47	41.86	83.72
10	3	30	10 - 11.47 = -1.47	2.16	6.48
11	4	44	11 - 11.47 = -0.47	0.22	0.88
13	1	13	13 - 11.47 = 1.53	2.34	2.34
15	5	75	15 - 11.47 = 3.53	12.46	62.30
$\sum f = 15$				$\sum f(x - \bar{x})^2 = 155.72$	

As variance: $S^2 = \frac{\sum f(x - \bar{x})^2}{\sum f}$ put values

$$S^2 = \frac{155.72}{15} = 10.38$$

$$\text{Standard deviation} = \sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}} = \sqrt{\frac{155.72}{15}}$$

$$\Rightarrow S.D = \sqrt{10.38} = 3.22$$

Q.3: The following is the distribution for the number of defective bulbs in 30 cartons (packs) .

No. of Defective Bulbs (x)	0 - 2	2 - 4	4 - 6	6 - 8	8 - 10
No. of packs(f)	1	3	15	10	2

Solution:

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Defective bulbs	f	Mid value (x)	f.x	x^2	$f.x^2$
0 – 2	1	$\frac{0+2}{2} = 1$	$1 \times 1 = 1$	$(1)^2 = 1$	$1 \times 1 = 1$
2 – 4	3	3	9	9	$3 \times 9 = 27$
4 – 6	15	5	75	25	375
6 – 8	10	7	70	49	490
8 – 10	2	9	18	81	162
$\sum f = 31$		$\sum fx = 173$		$\sum fx^2 = 1055$	

As variance $S^2 = \frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2$ (i) Put values

$$\Rightarrow S^2 = \frac{1055}{31} - \left(\frac{173}{31} \right)^2 = 34.03 - (5.58)^2$$

$$\Rightarrow S^2 = 34.03 - 31.14 = 2.89$$

$$S.p = \sqrt{S^2} = \sqrt{2.89} = 1.7$$

$$\Rightarrow S.D = 1.7$$

Exercise (Objective Type) 10.5:

Q.1: True / False Questions .

Encircle "T" for true statement and "F" for false statement .

- (i) Lower limit of the class 10 – 20 is 10 T - F
- (ii) The class boundary of 3 – 5 is 2.05 – 5.05 T - F
- (iii) The mid point of 0 – 4 is 3 . T - F
- (iv) For histogram we need the class limits . T - F
- (v) The widths of the rectangles in the histogram
for unequal intervals are equal . T - F

Answers: (i) T (ii) F (iii) F (iv) F (v) F

Q.2: Fill in the blanks.

- (i) The Geometric Mean of 2 and 8 is

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(ii) For cumulative frequency polygonfrequency is required .

(iii) If n is odd then $\left(\frac{n+1}{2}\right)$ th item is called

(iv) There are types of frequency distribution .

(v) Frequency polygon is obtained by connecting

Answers:(i) 4 (ii) c.f. (iii) Median (iv) Two (v) Mid points .

Q.3: Multiple choice:

For each question , four suggested answers are given ,
Chose the correct one and write as a, b, c and d
in the box,

(i) The difference of the largest and smallest value in
The data is called

(a) Mean (b) Mode (c) Range (d) standard deviation

(ii) The formula $\frac{\sum x}{n}$ determines .

(a) Arithmetic Mean (b) Median (c) Mode (d) G . M.

(iii) To find the sub class – boundaries for $2 - 3$, $4 - 5$,
then is subtracted from lower limit and
added to the upper limit .

(a) 0.5 (b) 0.05 (c) 0.005 (d) 5

(iv) $\frac{\sum f(x - \bar{x})^2}{\sum f}$ is called

(a) Range (b) Median (c) S . D . (d) Variance .

(v) The most frequent value in the data is called its ...

(a) Mean (b) Median (c) Mode (d) G . M.

Answers: (i) c (ii) a (iii) a (iv) d (v) c